WISCONSIN'S SOURCE WATER ASSESSMENT PROGRAM PLAN

Prepared by the Wisconsin Department of Natural Resources
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Table of Contents

Appendices

List of Acronyms

AHAC - Safe Drinking Water Act Ad Hoc Advisory Council
CFR - calculated fixed radius
EPA - U.S. Environmental Protection Agency
GCC - Groundwater Coordinating Council
GIS - Geographic Information Systems
SDWA - Safe Drinking Water Act
SWAP - Source Water Assessment Program
WDNR - Wisconsin Department of Natural Resources
WHP - Wellhead Protection

Introduction

The 1996 Amendments to the Safe Drinking Water Act (SDWA) require states to have a U.S. Environmental Protection Agency-approved state Source Water Assessment Program (SWAP). The main reason for implementing a SWAP is to protect public health by preventing contamination of public water supplies. Other benefits include preserving water resources for future generations; avoiding the expense of cleaning up a contaminated water supply or finding alternative sources of water; reducing system costs by providing the information needed to apply for a waiver from specific monitoring requirements and to develop a wellhead protection plan; and encouraging economic growth by assuring an abundant supply of clean water. The most immediate benefit of having an approved SWAP is fulfilling the requirement needed for the state to issue monitoring relief for chemical contaminants to water suppliers. Monitoring relief is issued in the form of waivers to costly monitoring of various chemical contaminants where it is shown to be unnecessary. An approved SWAP is also a condition for future funding for source water protection

This document presents the approach that the state of Wisconsin is proposing to meet the federal source water assessment requirements that are specified in the 1996 amendments to the SDWA. In general a state must prepare an assessment for each public water supply which includes: 1) delineation of assessment area boundaries for all public water systems; 2) inventory of significant potential sources of contamination within those boundaries; 3) a susceptibility determination for each system; and 4) release of the assessment results to the public water supplier and to the public.

Wisconsin will have two years, with a possible 18 month extension, to complete all source water assessments once its program description is approved by the U.S. Environmental Protection Agency (EPA). Wisconsin requests the 18 month extension in order to complete source water assessments for the following two reasons: 1) there are approximately 11,900 systems that use groundwater in the state; and 2) source water areas for the 20 systems that use surface water include approximately 12,500 square miles of land area. Work load and logistical problems inherent in conducting assessments on this scale necessitate the request for an 18 month extension.

State SWAPs must address both surface water and groundwater sources of drinking water. These sources will be assessed differently. Wisconsin has also chosen to take different approaches for assessing different types of public water systems. Public water systems are categorized as follows:

Community systems serve at least 15 service connections used by year-round residents or regularly serve at least 25 year round residents. They provide water to cities, villages, mobile home parks and residential centers such as nursing homes.

- A municipal system is a community system which is owned by a city, village, county, town, town sanitary district, utility district or a federal, state, county or municipally owned institution for congregate care or correction or a privately owned water utility serving any of the above.
- An other-than-municipal system is a community water system which does not fit the definition of a municipal system. Examples are mobile home parks, condominiums, apartments, or subdivisions.

Non-community systems are public water systems that are not community water systems.

- Non-transient non-community systems regularly serve at least 25 of the same non-resident persons per day for at least six months of the year and include places like schools and businesses.

- Transient non-community systems serve at least 25 different non-resident persons per day for at least 60 days of the year and includes places like campgrounds, roadside rest areas, gas stations, restaurants and churches.

The task of preparing source water assessments for Wisconsin's approximately 1,160 community and approximately 10,750 non-community public water supply systems is daunting given the time constraints imposed by Congress. However, the approach described in this document should satisfy federal requirements and build upon and integrate with existing efforts to protect public water supplies. The approach will make effective use of funding authorized by Congress through the state drinking water revolving fund to prepare source water assessments and to foster interest in using them to protect sources of public drinking water (For more information on SWAP funding see Section 4.2 on page 32).

Groundwater drinking water resources

Approximately 70% of Wisconsin's residents use groundwater. Only 20 of the state's community water systems use surface water although most of the major cities are entirely surface water-based systems. All of the state's non-community water systems use ground water. Groundwater is also the primary source of water for irrigated agriculture, and is very important for industry. Streams, lakes, and wetlands are fed by groundwater baseflow, thus fish, other aquatic life, and wildlife are as dependent on abundant, clean groundwater as are humans.

Major aquifers

About two million billion (2,000,000,000,000,000) gallons of water is estimated to be stored underground in Wisconsin. That is enough water to cover the state to a depth of 30 ft. Approximately 14 billion gallons of water are recharged to groundwater every day. The 1990 estimated daily use of groundwater in Wisconsin was about 600 million gallons.

The state's groundwater reserves are primarily held in the following four aquifers:

1. The sand and gravel aquifer is the surface material covering most of the state except for parts of southwest Wisconsin. The sand and gravel was mostly deposited from glacial ice or in river floodplains. In some places these aquifers are over 300 ft. thick. Though sand and gravel form some of Wisconsin's most productive aquifers they are also the most susceptible to contamination because they are closest to the land surface.
2. The eastern dolomite aquifer occurs in eastern Wisconsin from the Door County peninsula to the Illinois border. It consists of Niagara dolomite underlain by Maquoketa shale. This aquifer's productivity depends on how many fractures or bedding planes a given well intersects. Where the fractured dolomite occurs at or near the land surface, the groundwater can easily become contaminated.
3. The sandstone and dolomite aquifer is found over the entire state except in the north central portion. In eastern Wisconsin this aquifer lies below the eastern dolomite aquifer and the Maquoketa shale layer. In other areas it lies below the sand and gravel layers. It is the primary source of groundwater for the southern and western portions of the state and for large users of groundwater in the eastern portion of the state.
4. The crystalline bedrock aquifer underlies the entire state. In the north central region it is the only aquifer under the sand and gravel aquifer. The crystalline bedrock aquifer often cannot provide adequate quantities of good quality water for larger municipalities or industries.

Threats to Groundwater

Groundwater monitoring by state agencies to determine the extent of groundwater contamination in Wisconsin and identify the sources of contamination has found that the primary contaminants of concern are volatile organic compounds (VOCs), pesticides and nitrates.

Sources of VOCs include landfills, underground storage tanks, and hazardous substance spills. The Wisconsin Department of Natural Resources (WDNR) requires monitoring at state Environmental Repair Fund sites, abandoned facilities, Comprehensive Environmental Response Compensation Liability Act/ Superfund sites, leaking underground storage tanks, and spill sites. Thousands of public and private drinking water wells and monitoring wells have been sampled for VOCs. Of the 80 different VOCs that have been found in Wisconsin groundwater, trichloroethylene is the VOC found most often.

Pesticide contamination of groundwater results from field applications (i.e., nonpoint sources), pesticide spills, misuse, or improper storage and disposal (i.e., point sources). Serious concerns about nonpoint sources of pesticide contamination in Wisconsin were first raised in 1980 when aldicarb was detected in groundwater near Stevens Point. The WDNR, and other state agencies responded to these concerns by implementing monitoring programs, conducting groundwater surveys and developing administrative rules such as the Atrazine Rule.

Nitrate-nitrogen is the most common contaminant found in Wisconsin's groundwater. Detections of nitrate in private water supplies frequently exceed the state drinking water standard of 10 milligrams/liter (mg/l). Consumption of water that contains high concentrations of nitrate by infants under 6 months of age can induce a condition called methemoglobinemia or "blue baby syndrome." The chronic health effects of nitrate exposure are not well understood, however, many experts believe that long-term exposure may increase the risk of cancer.

Nitrate can enter groundwater from many sources, including nitrogen based fertilizers, animal waste storage and feedlots, municipal and industrial wastewater and sludge disposal, refuse disposal areas, and private sewage systems. A recent study by the Department of Agriculture, Trade and Consumer Protection (DATCP) (LeMasters and Baldock, 1997) estimates that 10% of Wisconsin wells exceed the groundwater enforcement standard of 10 ppm as nitrate-nitrogen. This percentage has been estimated at 6.5% by a Center for Disease Control (CDC) study, and 9-14% by existing databases maintained by various agencies However, concentrations of nitrate in groundwater are not uniform across the state. Nitrate is frequently undetectable (less that about 0.5 ppm as nitrate-nitrogen) in forested areas. Contamination is generally higher in agricultural parts of the state. The DATCP study showed 17-26% of wells exceeding the groundwater enforcement standard in some districts where agriculture predominates. Locally, exceedence rates greater than 60% have been reported in agricultural areas(Central Wisconsin Groundwater Center, unpublished data). Where high density unsewered developments occur, septic systems can cause nitrate pollution.

Existing groundwater protection programs

Wisconsin has a long history of groundwater protection. Wisconsin's Groundwater Protection Act (1984) created chapter 160, Wisconsin Statutes, the backbone of Wisconsin's groundwater protection program. Chapter 160 provides a multi-agency comprehensive regulatory approach using two-tiered numerical standards, based on the premise that all aquifers in Wisconsin are entitled to equal protection. This approach is in contrast to the nationwide groundwater approach proposed in the 1980's. A keystone of the national approach was aquifer classification - a scheme whereby each aquifer would be classified according to its potential use, value or vulnerability, and then would be protected to that classification

level. Wisconsin viewed this approach as "writing off" certain aquifers as industrial aquifers not entitled to protection and never again usable for human water supply. Wisconsin said "no" to aquifer classification. The philosophical underpinning of Wisconsin's groundwater law is the belief that all groundwater in Wisconsin must be protected equally to assure that it can be used for people to drink.

The state's philosophy of equally protecting all groundwater, coupled with the uncertainties associated with determining areas of contribution for wells, supports using a comprehensive approach to protecting source waters. In addition to delineating source water areas and conducting potential contaminant inventories within those areas, the state will encourage and support the integration of broader statewide efforts into the SWAP. Efforts will be made to coordinate data collection efforts with other programs to create statewide data layers of significant potential sources of contamination and/or statewide groundwater susceptibility information.

In establishing the groundwater law, the Wisconsin Legislature recognized that management of the state's groundwater resources was a responsibility divided among a number of state agencies. Therefore, the Groundwater Coordinating Council (GCC) was created to advise and assist state agencies in the coordination of non-regulatory programs and the exchange of information related to groundwater. The GCC has been meeting quarterly since 1984. Members include appointees of the Secretaries of the Departments of Natural Resources; Commerce; Agriculture, Trade and Consumer Protection; Health and Family Services; Transportation; the President of the University of Wisconsin System; the State Geologist; and a representative of the Governor.

The GCC and its five subcommittees have been briefed on the SWAP. In 1998 and 1999, the GCC addressed SWAP-related issues such as automated well construction data format coordination, electronic data submittal, state and county data integration, mapping Wisconsin's karst features, collecting locational data using global positioning system devices and address-matching techniques, and data management needs of local units of government. The GCC will continue to play a role in coordinating the exchange of information necessary for a successful SWAP.

The SDWA requires states to develop and implement wellhead protection (WHP) programs for protecting public water supply wells. Wisconsin's wellhead protection program was approved by the EPA in September, 1993. WHP plans are required for all municipal wells installed after May 1, 1992. For wells installed before that date, WHP plans are voluntary.

The WHP program shares two key requirements with the SWAP. This overlap consists of:

- delineations of recharge areas designated as protection areas for groundwater wells; and
- inventories of potential contaminant sources within the protection areas.

The SWAP will assist the state's WHP program greatly by providing the delineations and potential contaminant inventories to the water supply systems. Wellhead protection efforts will focus on working with communities that have not yet completed wellhead protection plans to prepare WHP plans in conjunction with SWAP implementation. Source water protection efforts subsequent to the SWAP will largely consist of continuing and enhancing these efforts.

Other groundwater protection programs include:

- regulation and groundwater monitoring of proposed, active, and inactive solid waste sites
- clean up actions at spills, abandoned containers, state funded responses, closed wastewater and solid waste facilities, hazardous waste corrective action and generator closures and contaminated sediment sites

- reimbursement programs for petroleum, dry cleaner, pesticide and fertilizer spill site clean ups
- Wisconsin Pollutant Discharge Elimination System permitting of wastewater land disposal sites.
- animal Feedlot permitting
- pesticide state management plans
- pesticide prohibition areas and related monitoring for pesticides in groundwater
- private sewage system regulation
- petroleum tank regulation
- road salt storage and application

Wisconsin's surface water drinking water resources

The name Wisconsin is derived from the Ojibwa, "gathering place of waters". This reflects an inherent appreciation of the numerous rivers, streams, and lakes in the state. Wisconsin has 982,163 surface acres of lakes and reservoirs, 57,698 linear miles of streams and rivers and 1,017 linear miles of Great Lakes shore line. Of these resources only the Great Lakes, Lake Winnebago and Rainbow Lake are used for public water supply sources at this time.

Although there are only 20 public water supply systems which use surface water, these systems serve over 1.5 million of the state's 5 million residents. All but one of these systems have intakes on either Lake Michigan, Lake Superior or Lake Winnebago. The size of these lakes and their watersheds is so large that detailed assessments of source water areas will not be attempted. The challenge of preparing assessments for source water systems is to select a realistic level of detail for potential contaminant inventories while still providing adequate susceptibility determinations.

Threats to surface waters

Wisconsin's public water suppliers have an excellent record of providing safe drinking water. However, no one can guarantee that an accident will not happen, and a mishap can have serious consequences. In 1993, the City of Milwaukee's public water supply became contaminated with *Cryptosporidium*, a parasite found in animal wastes. Nearly half of the 850,000 consumers were infected, 4,400 people were hospitalized, and at least 69 people died, making this the largest documented waterborne outbreak in U.S. history (Wisconsin Division of Health, 1996). Although the exact source of the *Cryptosporidium* that caused this outbreak is still uncertain, it is known that a water treatment process failure related to coagulent dosing contributed to the disaster. This dramatic example illustrates the need for a multibarrier approach to preventing public water supply contamination.

Wisconsin's surface waters are threatened by both point and nonpoint sources of contamination. Point sources include both municipal and industrial discharges. Nonpoint sources include a wide range of activities ranging from urban stormwater to agricultural runoff.

Existing surface water protection programs

Wisconsin has been a leader in protecting surface water as well as groundwater. A few of the many programs implemented to protect surface waters are:

1. Outstanding Resource classification/Exceptional Resource classification and antidegradation program;
2. Water quality standards and effluent limit calculation loads;
3. Wisconsin nonpoint source/priority watershed program and redesigned priority project program;

4. Lake Superior Binational Agreement and Program (Zero Discharge and Mercury Reduction);
5. Lakes Michigan and Superior Lakewide Management Plans and Lake Michigan Tributary Loadings Analyses;
6. Integrated Watershed Planning Activities; and
7. Shoreline/Waters Initiative.

The programs above will be integrated with the SWAP by encouraging recognition of source water areas in planning, watershed scoring and prioritizing activities. The goal of the Wisconsin SWAP is to minimize the potential of contaminants from these sources that may affect human health.

Rationale for SWAP goals and objectives

The WDNR is the lead agency in the state for administering the public water supply supervision program, the groundwater program, and the wellhead protection program. Although WDNR also has the lead in developing the SWAP and preparing source water assessments, it has relied on input from representatives of public water suppliers, state and local governments, business, well drillers, industry, agriculture, tribes, environmental groups, and the general public to prepare this document. Furthermore, a considerable effort has been made to keep the public informed of source water assessment issues as the state has developed the program.

The overall goal of the Wisconsin's SWAP will be to gather and utilize meaningful information to assist source water protection efforts and the overall drinking water program in the state. Efforts to identify significant potential sources of contamination will focus on the greatest threats to drinking water, guide future source water protection efforts, and be useful to the state's public water system supervision program. The SWAP assessments are intended to be fully consistent with the Groundwater Rule. Every attempt has been, and will continue to be, made to prevent duplication of efforts to satisfy SWAP and Groundwater Rule requirements.

The SWAP will maximize the use of existing information, require integration with existing state and federal programs, and use Geographic Information Systems (GIS) to map delineations and assessments. The finished assessments will indicate the direction and intensity of subsequent source water protection efforts. The products listed below are intended to assist cooperative efforts among state agencies, local governments, public water systems, and the general public:

X GIS databases that can produce maps of delineated source water protection areas showing the locations of significant potential sources of contamination;

X analyses of the natural resource characteristics that affect the sensitivity of the aquifers and surface waters to contamination;

X analyses of the water supply system characteristics that affect the vulnerability of the system to contamination;

X vulnerability assessments for developing targeted monitoring of chemical and radiological contaminants; and

X information useful for future regulatory decisions.

Summary of program plan

This plan for Wisconsin's SWAP is divided into 5 chapters. Chapter 1 is a summary of the public participation efforts that the state has initiated and continues to maintain to hold a dialogue with public water system stakeholders on the SWAP. Chapter 2 is a description of how Wisconsin proposes to prepare source water assessments for groundwater and surface water-based systems. Chapter 3 describes how the assessment results will be made available to the public, including discussions of the contents and availability of assessments. Chapter 4 covers program implementation, including a request for an 18-month extension, answers to questions on funding, the program timeline, and other important practical considerations. Chapter 5 shows how Wisconsin plans to use existing programs and the source water assessment results to protect public water supply sources.

Chapter 1 - Public Participation

1.1 Approach to Public Participation

Public involvement has been encouraged throughout the development of Wisconsin's SWAP through WDNR's efforts to solicit input from public water system stakeholders at every opportunity. The Department's philosophy is to engage our partners in a dialogue to achieve common goals. We believe public involvement is an essential part of the development and implementation of a successful program, especially one with strong ties to public health such as the SWAP. To secure this involvement we have provided the following opportunities for all interested parties to learn about the program and provide detailed comments.

1.2 Public Information Meetings and Public Hearings

The public participation process began with a series of public information meetings held in Eau Claire, Fond du Lac, and Madison in May, 1997. See Appendix A for public comments and WDNR's responses to the comments that came out of the three public information meetings.

At the end of the SWAP plan development process four public hearings/informational meetings were held to obtain public comments on the draft plan. The hearings/informational meetings were held during the first week in January, 1999 in Eau Claire, Ashland, Green Bay, and Waukesha. A record of attendance, comments received, and responses to comments are included in Appendix V. Additionally a 30-day public comment period was held from December 21, 1998 through January 22, 1999. No written comments were received during this period. One set of comments was received after the 30-day comment period. These comments and the WDNR's responses are included in Appendix W. The WDNR considered the merit of all comments and suggestions relevant to the SWAP and has responded to them in writing as included in the appendices.

1.3 Safe Drinking Water Act Ad Hoc Advisory Council

A Safe Drinking Water Act *Ad Hoc* Advisory Council (AHAC) was formed in 1997 to address public input on all 1996 SDWA amendment programs (i.e. SWAP, Capacity Development, Technical Assistance and Operator Certification). The AHAC has been the primary advisory committee convened for stakeholder input on the SWAP. The AHAC consists of representatives from the following organizations:

WI Section, American Water Works Association/Cudahy Water Utility
WI League of Women Voters
WI Rural Water Assoc.
WI Manufacturers and Commerce
WI Conference of Churches
Municipal Environmental Group
WI Restaurant Association
WI Manufactured Housing Assoc.
WI Citizens for a Better Environment

WI Innkeepers Association/New Concord Inn
WI School District Administrators
WI Sierra Club
WI Department of Health & Family Services
WI Water Well Association
WI Association of Campground Owners

The membership of the AHAC was selected based on the number of public water systems and citizens that each group represented. The AHAC has met five times and has provided significant input on every aspect of the draft SWAP plan. Over the course of the last three meetings, three draft SWAP plans and specific questions relating to each key issue raised in EPA's Source Water Assessment and Protection Programs Guidance (Tables 1 through 6, Chapter 2) were addressed by the AHAC and other stakeholders (see Appendices B through H). Input was also received from the following groups and individuals at these meetings or in writing:

Door County Soil & Water Conservation Department
Farmer from Walworth County
Oneida Nation
Eau Claire City/County Health Department
Waukesha County Division of Environmental Health

A farmer from Washington County and representatives from the Chippewa Co. Land Conservation Dept. and the Wisconsin County Code Administrators were invited but declined to attend the last two meetings. The AHAC and other stakeholders have shown interest in continued involvement in assisting the WDNR in developing proposals on various aspects of the SWAP.

1.4 Role of the Technical Advisory Committees

In two cases, issues came up that required advice from technical experts outside of the WDNR and the AHAC. In these cases, technical advisory committees were convened to address the technical aspects of the issues.

Surface Water Delineation Technical Advisory Committee

This committee met on July 9, 1997 and August 18, 1997 to discuss the delineation of source water protection areas for surface water systems. The committee consisted of representatives from the U.S. Geological Survey, CH2M Hill - Milwaukee, University of Wisconsin - Milwaukee and the WDNR's Drinking Water and Groundwater, and Watershed Management programs. Members had expertise in hydrodynamics, contaminant transport and other areas. The committee developed separate strategies for source water area delineation for surface water systems with intakes on: 1) the Great Lakes, and 2) Lake Winnebago and Rainbow Lake. Several recommendations were voiced that the AHAC accepted and have been used to guide the delineation of source water protection areas (Appendix I and Section 2.8 of this report).

Groundwater Source Area Delineation Technical Advisory Committee

This committee is composed of groundwater modelers and hydrogeologists from the Wisconsin Geological and Natural History Survey, United States Geological Survey, University of Wisconsin - Stevens Point, and University of Wisconsin - Eau Claire. The formation of this committee is a direct result of input from the AHAC regarding the shortcomings of calculated fixed radius delineations for municipal systems in certain hydrogeologic settings. The TAC met on July 21, 1998 to discuss ways of targeting systems for consideration of more advanced delineation techniques. Several recommendations came out of the meeting that were accepted by the AHAC (Appendix J). The TAC has continued to provide input on advanced delineation strategies.

1.5 Newsletters and Surveys

The WDNR regularly publishes and distributes a Wellhead Protection Newsletter to water supply operators, consultants, engineers, local government officials and other interested individuals. The purpose of the newsletter is to share current WHP information and to encourage communities to develop WHP plans. The Spring 1998 issue included a description of the SWAP and a questionnaire for gathering input on the SWAP from system operators and local governments. This newsletter was sent to approximately 3000 people with a postage-paid return mailer. Approximately 1 percent were returned. A summary of the responses is included in Appendix K. The Fall 1998 issue, sent out in November, 1998 included additional SWAP information and a questionnaire with a return-postage mailer. A summary of the responses is included in Appendix L.

The Wisconsin Groundwater Association publishes a quarterly newsletter on items of interest to groundwater professionals. A full page article on the SWAP program explaining the public participation and delineation aspects of the program appeared in the Summer 1998 (Vol. 12, No. 3) issue.

The WDNR completed a survey of surface water system operators to find out what potential sources of contaminants were of greatest concern to these systems. Fifteen out of 20 system operators responded to the survey. Responses to the survey are summarized in Appendix M.

1.6 Wellhead Protection/ Source Water Assessment Program Web Page

In November, 1998 the WDNR added a Source Water Assessment Program page to its Bureau of Drinking Water and Groundwater web site. The page is accessible from the Bureau home page and a joint wellhead protection/SWAP page. The internet address of the page is:
http://www.dnr.state.wi.us/org/water/dwg/gw/swp.htm

The page includes the following sections:

- Why Do a Source Water Assessment Program?
- Wisconsin's Schedule of Activities
- Role of Public Participation in the Source Water Assessment Program Development
- Groundwater System Source Water Protection Areas
- Surface Water System Source Water Protection Areas
- Potential Contaminant Inventory
- Resource Characterization - Groundwater Systems
- Resource Characterization - Surface Water Systems
- Determining Susceptibility

- Other States, Federal and Tribal Lands, Contingency Plans and U.S. Environmental Protection Agency
- Making the Results of the Assessments Available to the Public
- State Program Implementation

The page will also include a downloadable version of this SWAP plan.

1.7 Miscellaneous Presentations and Other Information Distribution

The WDNR solicited program input from the following groups through personal presentations:

- WDNR Water Supply Engineers Statewide Meeting, 2/5/98
- Wisconsin Rural Water Association training sessions November 20, 1997 in Spooner; December 4, 1997 in Shawano; January 29, 1998 in Plover; February 19, 1998 in Whitewater; February 26, 1998 in Fennimore.
- Wisconsin County Code Administrators Spring Seminar (3/19/98)
- Wisconsin Environmental Health Association Board of Directors meeting (4/6/98)
- Department of Agriculture, Trade and Consumer Protection Groundwater Unit (5/13/98)
- Wisconsin Groundwater Coordinating Council (8/15/97, 11/21/97, 2/27/98, 5/29/98, 8/7/98)
- Drinking Water and Groundwater Statewide Meeting (10/14/98)
- Local government and utility staff through the Educational Teleconference Network (12/15/98)

1.8 Responsiveness Summary

Appendices B through H summarize the dialogue that WDNR had with it's advisory council, and other stakeholders on the WDNR's proposed SWAP strategies. This includes written and oral comments. The major points of advice that were offered by the AHAC or other stakeholders are listed below with the reference to the appropriate section of this report for the WDNR's response to that advice:

Stakeholder advice	WDNR response
Conduct a source water assessment program	Proposing a SWAP plan
Avoid redundancy in state programs. For example share data systems when possible and integrate with ongoing data gathering efforts.	See Chapter 2, especially Sections 2.10-2.12
Minimize surface water system assessments	See Sections 2.8, 2.10, 2.12, and 2.14
Conduct more detailed delineations for groundwater systems	See Sections 2.5 - 2.7

Chapter 2 - State Approach

2.1 Goals

The Safe Drinking Water Act states that the SWAP is "for the protection and benefit of the public water system" [SDWA 1453 (a)(1)]. To achieve this goal Wisconsin's SWAP will gather and utilize meaningful information to assist source water protection efforts and the overall drinking water program in the state. More specifically, source water assessments will provide basic information regarding 1) where a system's drinking water comes from and 2) the degree to which it may be adversely affected by potential sources of contamination. It should be recognized that these assessments are a starting point rather than a finished product. Assessment results can be used to educate citizens about protecting sources of public drinking water and should facilitate the development and implementation of effective strategies for managing potential contamination sources in source water areas.

A key point heard from the AHAC and others who provided input into the assessment process is that source water assessments must be integrated with other WDNR efforts to protect drinking water and other water resources to prevent redundancy and waste. We believe that the usefulness of the source water assessments will be amplified by effective integration of the program with other resource management efforts.

2.2 Linking Assessments to Ongoing or Future Assessments and Protection Efforts

The state of Wisconsin intends to use source water assessments to promote the development of plans for protecting public drinking water supplies from contaminants that may adversely affect human health. To prevent duplication of effort, every effort will be made to complete assessments so as to provide information needed for Groundwater Rule requirements. This plan has been developed before those requirements have been established. Therefore assuring that source water assessments provide information needed to make Groundwater Rule assessments will be an ongoing effort. Source water assessments will be prepared so they may interlink with wellhead protection plans, watershed protection plans or other source water protection efforts. Additionally, whenever practical, the state will integrate source water assessments with other state and federal water resource protection programs to maximize the effective use of SWAP funding.

2.3 Definitions of Susceptibility, Contaminants of Concern, Sensitivity, and Well Vulnerability

For the purposes of Wisconsin's source water assessments, susceptibility is defined as the likelihood that a contaminant of concern will enter a public water supply at a level that may result in an adverse human health impact. This definition applies to groundwater and surface water-based public water supplies. A susceptibility determination is based on a stepwise synthesis of information regarding the well or surface water intake vulnerability and the source water's sensitivity to a potential source of a contaminant of concern.

Contaminants of concern are those which are regulated under the SDWA. A listing of these contaminants and their human health effects can be accessed through the EPA web site at www.epa.gov/OST/Tools/dwstds.html. This list of contaminants of concern applies to both groundwater and surface water systems. Furthermore, additional contaminants may be included which meet both or either of the following criteria:

- any contaminant being considered by EPA as a future regulated contaminant; or

- a non-regulated contaminant suspected by the water supplier as existing in the delineated source water assessment area which may present a health concern to the users of the public water supply system.

Note that this does not necessarily mean we will be identifying all significant potential sources of these contaminants in our assessments for surface water systems. Significant sources of the above contaminants have been identified for groundwater systems in the Public Water Supply Potential Contaminant Use Inventory Form 3300-215 (Appendix N). For surface water systems the list of significant potential sources will be more limited as discussed in Section 2.12.

Sensitivity is defined as the likelihood that an aquifer or surface water will be impacted by contaminants due to the intrinsic physical attributes of the geologic setting or geomorphology.

Well vulnerability is defined as an assessment of the likelihood of contamination entering a public water supply well that is based on one or more of the following: 1) the construction of the well, 2) the geologic sensitivity of the area around the well site, and 3) the results of water quality monitoring.

2.4 Level of Exactness and Detail that an Assessment Will Contain

The time line specified by Congress to complete source water assessments limits the level of detail that can be provided in each assessment. However, to meet the "usefulness" criteria discussed at the beginning of this chapter, the following guidelines will apply:

- A delineation of the source water area for each public water system will include a map that indicates the well location, source water area boundaries, and the type and location of potential sources of contamination within that area.

- Baseline delineations of source water areas for groundwater systems will include the estimated 5-year time of travel for municipal systems (with a minimum radius of 1200 ft.), 1200 ft. fixed radii for other-than-municipal and non-transient non-community systems, and 200 ft. radii for transient non-community systems.

- The degree of locational accuracy attained will be determined by the method of collection. Most well locations will be determined by global positioning system post-processing technology accurate to within 15-20 ft. Some other-than-municipal and non-transient non-community systems will be located by on-screen digitizing which is accurate to approximately 40 ft. Potential contaminant source locations for municipal, other-than-municipal and non-transient non-community systems are being digitized on-screen which is closer to 40 ft accuracy. Global positioning systems may be used in conjunction with on-site distance measurements to efficiently field-locate potential contaminant sources around transient non-community wells.

- A susceptibility determination will be made that reflects 1) the construction of the well(s) or intake(s), 2) the sensitivity of the hydrologic or hydrogeologic setting of the well(s) or intake(s), 3) results of previous contaminant monitoring of the source water, 4) the presence of potential contaminant sources in the source water area; and 5) other relevant studies conducted on the source water.

2.5 Differential Assessments for Public Water Supply Systems

Groundwater Systems *vs*. Surface Water Systems

Assessments for groundwater systems will be done differently than those for surface water systems. For groundwater systems, potential sources of contamination will be at least those that may generate any contaminant regulated under the federal SDWA, plus bacteria and viruses of human health concern. A list of potential sources of contamination was generated for vulnerability assessments and was expanded for the source water assessments by adding potential sources listed in EPA's State Source Water Assessment and Protection Programs Guidance. This list to be used for contaminant inventories for groundwater systems is included in Appendix N.

For surface water systems, contaminants of concern are the same as for groundwater systems but contaminant inventories will be conducted differently. Input from the AHAC indicated strong stakeholder interest in less detailed contaminant inventories for surface water systems. This primarily reflects two factors: 1) all surface water systems in Wisconsin treat drinking water; and 2) assessments for surface water systems will cover a much larger land area than those for groundwater. The enormous land area included in surface water system source water areas (approximately 22 percent of the state) makes detailed potential contaminant source inventories difficult, if not impossible with the resources available. It was agreed that inventories for surface water systems would focus on assessing existing land use data and cooperating with existing efforts to gather inventories of the most serious potential contaminant sources. Potential contaminant source data exists in the WDNR's watershed management, waste management and remediation and redevelopment programs. Currently, the WDNR has identified large animal feedlots, landfills, hazardous waste generators, Superfund sites, emergency response and repair sites and WPDES permitted facilities as potential sources of contamination for surface water system contaminant inventories. Potential source inventories will be compiled using these data resources.

Assessments for Different Types of Groundwater Systems

Assessment strategies for groundwater systems will vary depending on the groundwater system type and hydrogeologic setting. Community systems will receive the most attention. These systems serve the greatest number of people and have been prioritized for wellhead protection efforts by the state and for source water protection efforts by EPA.[1] Municipal community systems' source water areas are being delineated using more advanced methods than those used for other-than-municipal community and non-community systems. Assessments for municipal systems will reflect more hydrogeologic, well construction and water use information. Municipal systems will use a calculated fixed radius or modeled delineation while other-than-municipal community and non-community systems will be delineated using a fixed radius: 1200 ft. for other-than-municipal community and non-transient non-community systems,

[1] An EPA source water protection goal is "by the year 2005, 60 percent of the population served by community water systems will receive their water from systems with SWP programs in place under both WHP and watershed protection programs."

and 200 ft. for transient non-community systems. Potential contaminant source inventories and susceptibility analyses will also be more detailed for community and non-transient non-community systems than for transient non-community systems.

Source water assessments for community and non-transient non-community systems will address the chronic health effects of contaminants in addition to acute health effects, while transient non-community water supply systems are required to assess for potential sources of contamination responsible for acute health effects only. Therefore the contaminants of concern for transient non-community water supply systems are, at a minimum, nitrate nitrogen and bacteria. In addition, assessments for transient non-community systems will consider the Ground Water Rule being developed by EPA and will include a susceptibility determination for viruses.

2.6 Baseline Groundwater System Delineations

The State of Wisconsin Wellhead Protection Program Plan for Public Water Supplies was approved by Region 5 USEPA in September 1993. This plan specifies delineation approaches based on system type and is the basis for Wisconsin's SWAP plan for groundwater systems. Since the approval of the wellhead protection plan several developments have led to revisions of the state's groundwater system delineation approach. These developments and revisions are as follows:

- With passage of the 1996 Amendments to the federal SDWA, funding has become available for source water area delineations through the SWAP set-asides. This will allow greater use of state funding to support more advanced delineations for groundwater systems.

- Automated mapping computer software in the form of GIS technology has facilitated the ability of the state to quickly map all types of delineations and to revise or update previous delineations.

- Groundwater flow modeling techniques have progressed to the point where regional-scale flow modeling is a practical and efficient option, in many areas of the state, for completing advanced area-wide delineations for multiple systems. Regional groundwater flow modeling projects will delineate assessment areas for municipal systems where appropriate and practical.

- Until recently, a one-year time of travel was recommended by U.S. EPA to protect wellheads from bacteria and viruses. Recent discussions at the national level to determine Groundwater Rule requirements indicate that a time-of-travel needed to protect public water supply systems from pathogens is now estimated at approximately 14 months. A Minnesota study showed that one-year time-of-travel capture zones for transient non-community wells in unconfined porous media are unlikely to exceed 155 ft. in the upgradient direction (Appendix III of Appendix O). Only one of the three simulations reported produced a capture zone that extended more than 200 ft. in any direction from the well. This simulation was based on a hypothetical, 200-guest four-season resort using 60 gal/guest, pumping from a poorly performing aquifer receiving no recharge and produced a capture zone 210 ft. long in the upgradient direction. Due to the worst-case water usage, aquifer recharge and transmissivity estimates used in this exaggerated scenario, we feel that the actual 14-month capture zones for transient non-community systems in Wisconsin will be considerably smaller than the simulated 210-ft long capture zone. The enormous safety factors used in this simulation should more than account for the difference between the modeled one-year time of travel and a 14-month time of travel. Therefore, a 200-foot radius should be protective for transient non-community wells in saturated porous media

aquifers. This indicates that the 1200-foot arbitrary fixed radius delineations originally proposed for these types of systems is too large an area for these types of systems and an inefficient use of limited resources.

Given these factors, source water protection areas for public water supply systems using groundwater will be delineated using the following baseline methods. To maximize the potential of SWAP funding, these delineation methodologies vary according to system type.

Municipal wells

The results of groundwater flow modeling will be used to delineate source water areas for municipal systems if available. The WDNR will support modeling studies in appropriate hydrogeological settings where sufficient population and community interest exist. For systems without advanced delineations, calculated fixed radius (CFR) delineations will be used for source water and vulnerability assessments (see Appendix P for a complete explanation of CFR methodology). The WDNR uses a CFR delineation method that calculates the size of a circular area around a well based on the pumping rate, the length of the well's open interval, aquifer porosity and a 5-year time period. To determine the appropriate pumping rate, a preliminary survey of 30 wells was made; the results showed that the average pumping rate was less than ½ of the well pump capacity. Therefore, the average annual pumping rate for one year (1997 or 1996) was used to calculate the fixed radius for delineations. A 1200-ft. radius was used for all wells with a CFR of less than 1200 ft. because 1200 ft. is the maximum separation distance to any potential contaminant source found in the public water supply code (NR 811, Wis. Adm. Code).

For systems in hydrogeologic settings where CFR delineations are not adequate, such as in confined settings, we intend to support 1) regional hydrologic studies that will generate delineations for multiple systems, and 2) system-by-system advanced delineations for selected communities as data availability and funding allow. Selection criteria for advanced delineations will include: 1) community interest in source water protection efforts, 2) inappropriate application of CFRs in the hydrogeologic setting, 3) likelihood of success in modeling the hydrogeologic setting, and 4) population served. For obviously technically inappropriate delineations the WDNR reserves the option of using its own delineations for the purposes of wellhead protection and source water assessments.

Other-than-municipal and non-transient non-community wells

CFRs were evaluated for these types of wells too, but it was determined that low pumping rates would result in all systems having less than 1200-foot radius delineations. Therefore the WDNR proposes to use a 1200-foot fixed radius for these systems. There is the possibility that some of these systems may be interested in completing more advanced delineations. WDNR will provide opportunities for funding of advanced delineations for other-than-municipal and non-transient non-community wells as funds permit. However, these systems will compete with municipal systems with larger populations for the limited resources.

Transient non-community wells

The US EPA's *State Source Water Assessment and Protection Program Guidance (Final Guidance, August 1997*) states "For transient non-community systems, a state may decide to conduct assessments that identify sources of microbial and nitrate contamination only within a specified distance from the

drinking water well, leaving more detailed assessment efforts for all community water systems (CWSs) and the majority of non-transient non-community water systems (NCWSs)" (p. 2-10). There are approximately 10,000 transient non-community wells in Wisconsin. The WDNR proposes to use a 200-ft. fixed radius delineation for transient non-community wells based on the impracticality of developing more sophisticated delineations for these systems, lack of owner's jurisdictional control off of the property, evidence of limited microbial transport, and the large amount of field work involved in doing assessments for these systems. These systems have very limited resources for protection programs and, like other-than-municipal and non-transient non-community wells, have no jurisdiction over land use outside their property boundaries.

There may be some limited efforts to conduct more advanced delineations for these systems. Results of regional flow modeling projects will be provided to the systems upon request. Modeling to determine if a hydrogeological barrier exists or to establish travel time may provide more accurate delineations and will be used when available. For source water areas determined by modeling we will require that the time of travel used in these determinations be that time period that EPA decides is appropriate for protection of public health from pathogens in the Groundwater Rule. Additionally, the option of conducting area-wide assessments for transient non-community wells is discussed in section 2.15 of this plan.

In summary, we propose a baseline 200-ft radius source water assessment area for TN systems and a 14 month time of travel (or as determined by EPA for the Groundwater Rule) to be used in hydrogeologic barrier determinations. This will enable us to focus limited resources on systems at greatest risk while providing baseline assessments for all of the approximately 10,000 TN systems in Wisconsin.

Factors considered in delineation method selection

Factors considered in determining groundwater source water protection area delineation techniques include: pump capacity *vs.* actual pumping rates, saturated thickness *vs*. open interval length, single porosity *vs.* weighted porosity, flow modeling *vs.* CFR, 5-year time period *vs*. 2-year time period. Other considerations include local factors that dictate the range of possibilities a community or system may have in implementing SWP/WHP measures and management approaches (e.g. jurisdiction over land use outside of property line). A key factor considered is that successful SWP/WHP requires support from the community.

2.7 Resource Characterization and Advanced Delineations for Groundwater Systems

Input received from the AHAC indicted strong stakeholder interest in the development of advanced delineations for groundwater systems in situations where benefits could be realized (Appendix E). In particular, the AHAC recommended that more appropriate delineation methods be considered for groundwater systems in karst and confined aquifer settings. Concern was also expressed by some AHAC members that calculated fixed radius delineations would not be adequate to protect municipal systems in many hydrogeologic settings where groundwater flow to the wells is primarily from one direction. In response to these concerns, a technical advisory committee was formed to define criteria to prioritize systems for more advanced delineations (Appendix J). Based on these criteria, the WDNR developed the groundwater resource characterization strategy below to aid in prioritizing systems where advanced delineations would be appropriate and the types of advanced delineation approaches to use.

To assess the potential effectiveness of advanced delineations and to complete these delineations where appropriate, hydrogeologic and well construction data must be gathered and hydrogeologic investigations must be completed. The primary data collection task will involve gathering well construction reports for all public water supply wells. Well construction reports provide geologic and well construction information needed to understand the aquifer as well as physical characteristics to evaluate the susceptibility of the well and other wells in the area. Despite the importance of these reports they are commonly not accessible, particularly for non-community wells. The WDNR proposes to locate well construction reports for as many public wells as possible in a two-year time period. Well construction reports will be gathered from WDNR Regional offices, the Wisconsin Geologic and Natural History Survey, and other agencies, and will be made available digitally.

In addition to well construction reports containing site-specific information, regional geologic data is needed to understand groundwater flow, especially in confined settings. The results of previous groundwater resource characterizations will be used to evaluate both the applicability of groundwater flow modeling for delineating source water areas and the susceptibility of the well to contamination. Based on the results of these studies the WDNR will use SWAP funds to support regional groundwater modeling studies in regions where high concentrations of municipal water systems are located, there is sufficient local interest, and the hydrogeologic setting is appropriate for modeling. SWAP funds will also be used to support and/or assist in conducting advanced delineations for individual municipal systems with community interest and appropriate hydrogeologic settings.

Karst Areas

Delineations for groundwater systems in certain problematic hydrogeological settings were addressed by the Groundwater Source Area Delineation Technical Advisory Committee. The committee recommended that mapping karst features in the vicinity of public wells would be useful for source water assessments in karst areas. These features can act as conduits for contamination at the surface to reach wells. There was a consensus that mapping karst features would be more effective than using a larger radius as suggested by some AHAC members. To promote the collection of karst feature information, the Planning and Mapping Subcommittee of the Groundwater Coordinating Council is preparing a karst feature reporting form to be used by staff from all agencies conducting field work in karst areas. Once available, this information will be used in the assessments of karst systems. It should be noted that carbonate bedrock underlies 1/3 of the state and that defining "karst areas" is challenging. In Wisconsin, areas with carbonate bedrock overlain by < 50 ft. of unlithified material are considered to be karst (Appendix Q).

Confined Areas

In confined settings, the Groundwater Source Area Delineation Technical Advisory Committee recognized a lesser potential for groundwater contamination from the surface around wells and a greater difficulty in delineating recharge areas. The committee recommended identifying recharge areas for large pumping centers, which can be accomplished by modeling regional groundwater flow. There was also consensus that the threat of contaminants penetrating confining layers through conduits such as improperly abandoned wells justified conducting advanced delineations using regional models. The WDNR has initiated a project with the United States Geological Survey to identify remote recharge areas and delineate 5-year time-of-travel source water areas for approximately 100 wells in Brown, Outagamie, Winnebago, Calumet, and Fond du Lac counties. The United States Geological Survey will update and adapt a model previously used for evaluating pumping regimes in the Lower Fox River Valley to produce capture zone delineations for municipal wells.

Regional Models and Advanced Delineations

The Groundwater Source Area Delineation Technical Advisory Committee identified groundwater susceptibility, population served, ease of modeling, and community interest as criteria for prioritizing communities for advanced delineations. These delineations will be completed as SWAP resources allow and will consist of groundwater flow modeling to determine 5 year time of travel zones of contribution to be used as source water assessment areas.

Regional groundwater modeling studies to determine source water assessment areas are underway in several other areas of the state. These areas include the Lower Fox River Valley, the seven Southeast Wisconsin Regional Planning Commission counties (Washington, Ozaukee, Milwaukee, Waukesha, Kenosha, Racine, and Walworth), Sauk County, Eau Claire County and the Central Sands Region. Similar studies in La Crosse, Rock, Pierce and St. Croix Counties are being considered for funding by WDNR and the local governments. These studies are being performed by the United States Geological Survey, the Wisconsin Geological and Natural History Survey and/or University of Wisconsin personnel and will provide delineations of source water assessment areas for all municipal wells in those areas. Additionally, pre-SWAP advanced delineations have been completed for Dane County, the City of Sturgeon Bay and several municipalities in Chippewa and Portage Counties.

Limited funding for the SWAP will not permit advanced delineations for all municipal wells. The baseline delineation methods described above will be used for municipal systems where groundwater modeling studies are not conducted. However, the WDNR will evaluate prioritizing the remaining municipal wells for advanced delineations as funding allows. The WDNR may prepare a solicitation for proposals to conduct advanced delineations for selected municipalities. Delineation funding will likely require a matching grant by the communities.

To determine that they are not susceptible to microbial contaminants, systems may need to determine if there is a hydrogeological barrier present or if the time of travel from the land surface to the well is sufficiently long enough to meet Groundwater Rule requirements (Figure 1). This requirement is most likely to apply to systems in karst, gravel/cobble, or fractured bedrock settings. Groundwater flow modeling may be used to determine the effectiveness of hydrogeological barriers and travel times. Results of these modeling scenarios may determine zones of contribution for systems that employ them. In these cases, the resulting delineated areas will be used as assessment areas.

2.8 Delineations for Surface Water Systems

Intakes for all but one of the 20 surface water systems in Wisconsin are located in one of the following large lakes: Winnebago, Superior and Michigan. One small system is located on Rainbow Lake in Waupaca County. Delineation requirements developed by the EPA specify that surface water system source water areas must include the entire watershed upstream of the intake up to the state border, if necessary.

Wisconsin convened a Surface Water System Delineation Technical Advisory Committee to determine delineations of source water areas for surface water systems. The Technical Advisory Committee (TAC) determined that, due to the different characteristics of these lakes, the source water areas should be delineated using strategies specific to the source water (Appendix I). For the systems with intakes in Lake Winnebago and Rainbow Lake the TAC determined that due to the high degree of mixing in these lakes, the entire Lake Winnebago and Rainbow Lake watersheds should be delineated and assigned to the associated intakes (Figure 9 of Appendix I)

Great Lakes Source Water Areas

For the 15 systems with intakes in Lake Michigan or Lake Superior the TAC recommended that, based on the size of the water sources and intake distribution, each Lake Michigan and Lake Superior intake/intake cluster be assigned an individual protection area that will include at least one locally discharging watershed (Figures 1 through 8 of Appendix I). The TAC preliminarily delineated source water areas based on the location of river discharges in relation to intakes. Established watershed boundaries (at the 14 digit hydrologic unit code level) were used in almost all cases. The TAC could not establish how much these nearby watersheds affect source water quality.

Based on concern over how to establish a protocol for deciding if an intake was likely to be impacted by shoreline impacts, Wisconsin is participating in a cooperative effort by Great Lakes states, led by Michigan, to develop an Assessment Protocol for Great Lakes Sources (Appendix R). This protocol examines ways to determine whether intakes for Great Lakes systems are at risk from specific shoreline contaminant sources. The draft protocol currently recommends that an initial survey be performed for each Great Lakes intake to assess local source water impacts. The survey would include: 1) reviewing any criteria or studies performed to locate the intake; 2) interviewing treatment plant personnel regarding raw water quality fluctuations; and 3) reviewing past water quality records for bacteriological content and turbidity levels, which are good indicators of local impacts.

The protocol proposes that if the initial survey indicates only minor fluctuations in the raw water quality, the source is probably not impacted by local contaminants and the assessment would reference general Great Lakes water quality and trends within the source water assessment area. However, for systems where the initial survey indicates a potential for localized contaminants, states will provide: 1) a delineation of the area that contributes potential impacts, and 2) an assessment of the impacts in the area and their relative impact on the quality and treatability of the raw water.

Recent refinements of the protocol have increased the ability of users to objectively categorize systems with intakes on the Great Lakes. A calculation of intake sensitivity will be used along with intake construction, lake bottom characteristics, localized flow patterns, and thermal effects to objectively complete a sensitivity analysis. The sensitivity calculation will be used to determine critical assessment zones for systems with shoreline impacts. The protocol includes a detailed discussion of what will be included in Great Lakes system assessments.

2.9 Conjunctive Delineations

As part of the 1986 Amendments to the Safe Drinking Water Act, states were required to determine which community and non-community public water systems use groundwater under the direct influence of surface water. In the early 1990's the WDNR conducted a study to develop a methodology to evaluate all of the public water systems without site specific determinations for each system (Appendix S).

In the study, 18 municipal wells were selected for evaluation based on recurring total coliform positives and proximity to a surface water. Of the eighteen wells, three were selected for longer term sampling and more intensive hydrologic evaluation. While the hydrogeologic evaluation indicated that the three wells were influenced by surface water, the sampling results showed that the wells were not under the direct influence of surface water (i.e. no coliform bacteria and only one sample showed *Giardia* presence (unconfirmed). The study also concluded that 1) *Giardia* cysts are not routinely present in the most

susceptible municipal groundwater supplies; and that 2) multiple sampling events cannot adequately determine the potential for *Giardia* contamination of groundwater supplies.

Based on this study, a method was developed for determining whether a groundwater system is under the direct influence of surface water. The methodology evaluates raw water total coliform test results, well construction, and well location (p.18 Appendix S). The method was completed in December 1992 and subsequently accepted by the EPA as the state protocol for determining whether a groundwater system is under the direct influence of surface water. Using this methodology, no community or non-transient non-community systems in the state have been found to be under the direct influence of surface water. Transient systems will be evaluated in the near future. We propose no special assessment methodology for wells determined to be under the influence of surface water but not under the direct influence of surface water because we believe almost all wells are influenced to some extent by surface waters.

If the state becomes aware of a system that may be under the direct influence of surface water, an evaluation of the system will be conducted in accordance with the decision process outlined in Figure 1 of Appendix S. If the groundwater system is determined to be under the direct influence of surface water, a surface water assessment will be conducted consisting of a delineation of the watershed, an inventory of potential contaminant sources in existing data layers, and a surface water susceptibility analysis (as described below) in addition to the groundwater assessment. The methodology used for the surface water assessment will be that used for Lake Winnebago system assessments as shown in the example for the fictional City of Laketon (Section 2.14).

2.10 Review of Existing Information and Programs Used to Prepare Assessments

Public input in the SWAP development process has indicated an overwhelming interest in minimizing or eliminating duplication in state data gathering activities (Appendices C and E). Thus, data coordination is a major focus of the SWAP development process, involving linkages with other programs that have an interest in potential contaminant source inventories or watershed/wellhead protection. This process has involved discussions among representatives of the Groundwater, Public Water Supply, Runoff Management, Waste Management, Remediation and Redevelopment, and Watershed Management programs of the WDNR on how to implement the SWAP. Data-sharing between programs and agencies will be a key component of Wisconsin's cost-effective source water assessment approach. These key data-sharing relationships will build a solid foundation for development and implementation of source water protection plans.

The state has large amounts of potential contaminant source data in many formats and locations. A major challenge for the SWAP is to ascertain its value and to integrate that data. WDNR proposes to integrate relevant data into a Geographic Information System (GIS) format. This effort will require cooperation among data managers at the local, state and federal levels. Cooperation should benefit all parties. Examples of how information sharing can benefit the SWAP include:

- The Waste Management and Remediation and Redevelopment Programs at WDNR have databases on numerous potential contaminant sources that can be used in SWAP potential contaminant inventories. These sources include licensed landfills, hazardous waste generators, mining sites, Superfund sites, scrap/junk yards, and emergency remedial response sites including leaking underground storage tanks and spills.

- The WDNR's Watershed Management Bureau will be collecting locational and other information on

large animal feedlots and wastewater outfalls. This information is valuable to both surface water and groundwater system assessments. With input and support from the SWAP, the locational information can be collected in a way that meets SWAP accuracy standards.

- Source water assessments will clearly be useful to communities interested in developing wellhead protection plans. The source water area delineations and potential contaminant source inventories completed through the SWAP are two of the major components of wellhead protection plans. In addition, susceptibility analyses offer a synthesis of information useful in preparing wellhead protection management plans. It is a primary goal of the Wisconsin SWAP to provide systems with information useful for preparing wellhead protection plans.

- The WDNR is developing an integrated watershed approach. This approach will be used to develop and implement integrated land and water management plans. The concept will likely emphasize identifying goals for individual basins and priorities to meet those goals. Implementation programs will then focus on the priorities. The SWAP will contribute information useful in resource assessments and in setting goals and priorities. Consequently, the type and quality of the information collected should be of use to regional and central office resource managers.

- Similarly, the nonpoint source grant program is developing a new system for scoring proposals for program funding. Source Water Protection Team members involved in developing the scoring system have included points for projects with wellhead protection or source water protection efforts implemented in the project area.

- Some local governments have information on potential contaminant sources. Officials in Eau Claire and Waukesha counties have shown interest in supplying potential contaminant source data and/or reviewing the potential contaminant source data that the WDNR collects.

- The WDNR has worked with regional planning commissions to co-fund regional hydrologic studies in Dane County, the seven county Southeast Wisconsin area, and the Lower Fox River Valley. The source water area delineations that result from these studies will be used in source water assessments and provided to the planning commissions for source water protection efforts.

- Regional planning commissions are also largely responsible for development and implementation of sewer service area plans in required areas. Land use and other data collected to define sewer service area boundaries and plans can contribute to data sets (as needed) for the SWAP. Likewise the WDNR has committed to incorporating wellhead protection area delineations (and by extension, source water protection area delineations) into the sewer service area planning process.

- The WDNR's Land Use Initiative focuses on providing enhanced data analysis capacity to regional planning commissions through the Land Use Team; annually, $60,000 will be available to provide key data layers and hardware to the agencies to enhance land use planning and protection efforts at the local level. SWAP data can eventually be provided to regional planning commissions through this effort to maximize the usefulness of data gathering efforts.

- Vulnerability assessments have been substantially improved and are now able to gather information useful for potential contaminant source inventories and susceptibility determinations. Vulnerability assessments will continue to provide a large portion of the information gathered for community and non-transient non-community groundwater systems.

- The Underground Injection Control program is planning on using SWAP potential contaminant source inventories to gather more accurate Class V injection well locations.

- The SWAP will work with the Capacity Development program to provide resource evaluations to prioritize capacity development efforts.

The WDNR did an initial review of many available data sources that provide contaminant source data by tabulating contact information for the potential contamination sources listed in Appendix E of EPA's draft State Source Water Assessment and Protection Programs Guidance. This list of sources was compared with those on a contaminant use inventory form used for vulnerability assessments which primarily contained potential sources of VOCs, pesticides, industrial chemicals, asbestos, and coal tar. Potential sources from both lists were merged into a new list, which will now be used for vulnerability assessments and potential contaminant source inventories for source water assessments (Appendix N). The new contaminant use inventory list includes potential sources of all contaminants regulated under the federal SDWA, plus bacteria and viruses of human health concern.

The WDNR has entered into discussions with managers of potential contaminant source data sources to develop data sharing methods and to work with GIS experts to map potential contaminant source locations. Whenever possible, field staff conducting potential contamination source inventories will be provided computer generated maps that identify potential contaminant sources contained in shared databases. This will give staff preliminary information that will help them conduct a more complete inventory when out in the field; this process will also help ground-truth and update existing databases.

The availability and locational accuracy of the data for these potential sources will be a factor in their utility. Some data will exist only as decentralized paper files; other data may be available as complete GIS data layers. Availability and accuracy will be factors in selection of potential contaminant sources for surface water system source water assessments. A summary of available potential contaminant source information is included in the Directory of Groundwater Databases (pp. 33-37 of Appendix T). For important potential contaminant sources with existing general locational data in Public Land Survey System (¼-¼ section) or street address format, the sources will be improved to latitude-longitude coordinates with global positioning systems or by digitizing into GIS at 1:24,000 scale accuracy.

Data describing geological and hydrologic conditions and potential sources of contamination must be referenced to known geographical coordinates and at a mapping scale that is at least 1/24,000 or greater. Analytical data must be generated using methods approved by U.S. EPA or the Public Water Supply Supervision Program. The purpose for these requirements is to ensure that 1) information presented in map form is accurate and understandable to the reader, and 2) factual data are used to support source water assessments and subsequent WHP/SWP planning.

2.11 Inventories of Potential Contaminant Sources for Groundwater Systems

Potential contaminant inventories for groundwater systems will target contaminants regulated under the SDWA. Potential sources of these contaminants were identified when the state's vulnerability assessment program was developed. As described in section 2.10 the list of potential contaminant sources was recently expanded to include sources suggested in Appendix E of EPA's Source Water Assessment and Protection Programs Guidance. Potential contaminant sources to be identified for groundwater system assessments are listed in Form 3300-215 - Public Water Supply Potential Contaminant Use Inventory (Appendix N). The form includes an explanation sheet describing these potential sources and how they will be located on a map, and listing specific contaminants likely to be present. Form 3300-215 was used for potential contaminant source inventories for vulnerability assessments for municipal systems in 1998

and for other-than-municipal community systems in 1999.

Vulnerability assessments are intended to offer monitoring relief to systems by determining if they are vulnerable to certain classes of contaminants (See Appendix U). Monitoring requirements for volatile organic compounds, inorganics, polychlorinated biphenyls (PCBs), and pesticides may be waived if the systems are found not to be vulnerable to them. Federal regulations specify that vulnerability assessments include a state determination of: 1) whether the chemicals have previously been used "within the watershed or zone of influence" of the well; and 2) the "proximity of the water system to potential point or non-point sources of contamination." Therefore WDNR's vulnerability assessments program will be coordinated with the SWAP to produce potential contaminant source inventories for both programs.

In the vulnerability assessment process, community and non-transient non-community groundwater system operators verify the presence and update the location of potential contaminant sources in an area delineated by WDNR. The vulnerability assessments are updated every three years with a different system type updated annually (i.e. other-than-municipal systems in 1999, non-transient non-community systems in 2000, municipal systems in 2001). Potential contaminant sources identified in vulnerability/source water assessments will be mapped in delineated source water areas and made available in GIS format. Based on the results of the 1998 and 1999 vulnerability assessments, WDNR may continue to revise the contaminant inventory strategy for groundwater system assessments for source water assessments for the years 2000-2002.

Potential contaminant source inventories for transient non-community systems will be completed by regional WDNR staff . Each of the Department's five Regions will employ personnel to locate and assess transient non-community systems. Well locations will be determined with global positioning systems technology to an accuracy of 3 to 5 meters using differential correction techniques. Additional information needed for susceptibility determinations will also be collected by these staff.

2.12 Inventories of Potential Contaminant Sources for Surface Water Systems

The combined watershed area of Wisconsin's 20 surface water systems is approximately 12,500 mi^2 or approximately 22 percent of the land area of the state. Based on advice from the Surface Water Delineation Technical Advisory Committee, the WDNR initially proposed tiered assessments of watershed segments consisting of more detailed potential contaminant inventories for subwatersheds close to intakes and less detailed potential contaminant inventories for subwatersheds farther from the intakes. Other factors such as land use and industrial concentrations would also be accounted for in this approach. The AHAC rejected this strategy as being too costly and advised that the assessment strategy for surface water systems be scaled down to a minimum; pointing out that the land areas are too large for potential contaminant source inventories to be completed with existing SWAP funding (Appendix E).

In response to this advice, the WDNR successfully proposed to the AHAC that potential contaminant inventories in surface water source water areas be limited to identification of land uses currently available in GIS layers and identification of a few key potential contaminant sources that are also targeted in groundwater system assessments (Appendices F and G). This approach can be implemented most efficiently by working with other environmental management programs to collect data on potential contaminant sources of mutual interest. Although this involves assisting in data collection for areas not currently in delineated source water areas, there are several good reasons to collect data on a statewide basis for both surface water and groundwater public water system protection. These reasons include:

- Non-statewide data layers are unlikely to get support from other programs and be completed cost-efficiently because other programs are generally interested in statewide data sets. Communication

with other programs that have data sets of major potential contaminant sources indicates that these programs are not interested in cooperating with data gathering/updating initiatives that will cover only source water areas.

- Wisconsin's Groundwater Law protects all groundwater equally. This approach is used because Wisconsin has chosen not to classify aquifers. The widespread growth of communities that depend on groundwater indicates that it makes sense to assess the resource and protect future public water systems.

- Delineating groundwater system source water areas is difficult and technology improvements will enable us to improve our delineations. For example, recent regional modeling of the confined system in the Lower Fox River Valley has shown that recharge areas are many miles away from water supply wells and that travel times from the water table surface to the wells are on the order of thousands of years. These delineations are a substantial improvement over simpler delineations such as the calculated fixed radius or arbitrary fixed radius baseline delineations. Improved delineations will likely include new areas not inventoried in our initial source water assessments (using a limited approach). Having statewide data layers would simplify the reassessment process by providing easy access to key potential contaminant sources.

- Groundwater and surface waters are connected. Although it is quite difficult to determine these connections, it is likely that there are groundwater systems that are receiving recharge from surface water. Groundwater systems affected by surface water may be vulnerable to contaminants in nearby or distant watersheds that would not show up in the potential contaminant source inventory completed for the system. The risk involved justifies using a comprehensive statewide approach to identifying the most significant potential contaminant sources.

- Almost 1/4 of the state is included in surface water source water areas (Figures 1-10 of Appendix I). A large portion of this area is in the most populated part of the state and contains a large portion of the potential contaminant sources in the state. Sharing the costs of collecting and managing statewide data layers is an efficient way of assessing this area in a way that meets federal SWAP expectations.

To identify key potential contaminant sources for statewide data integration, Bureau of Drinking Water and Groundwater staff have met with representatives from the Watershed Management, Waste Management, and Remediation and Redevelopment programs and have discussed cooperatively building data layers that will be useful to the SWAP, as well as to manage the environment in an integrated and comprehensive fashion. A preliminary list of potential contaminant source layers to be cooperatively collected includes: land use (including agricultural land) large animal feedlots, landfills, hazardous waste generators, Superfund sites, emergency response and repair sites and WPDES permitted facilities. These layers are chosen because of their potential to threaten public water supplies and the capacity for cooperation with other programs to complete the work. Efforts needed to complete these layers generally consist of preliminary data review and accurate site location using differentially corrected Global Positioning Systems technology. To maximize benefits from the SWAP funds, WDNR will seek opportunities to work cooperatively with other programs to gather information useful for surface water and groundwater system assessments. By the end of this statewide data collection effort GIS coverage for these sources will be statewide and will be available for all surface water systems' source water areas. This data will be supplemented with data collected specifically for the SWAP in groundwater system assessment areas and Great Lakes system critical assessment zones.

2.13 Susceptibility Determinations for Groundwater Systems

Susceptibility determinations for public water supply wells will consist of a stepwise assessment of:

1. Well vulnerability based on existing raw water quality monitoring data;
2. Geologic sensitivity of the well site, or an assessment of the geologic sensitivity of the area as determined by nearby wells or in regional studies;
3. Whether the well's construction meets the current state Well Code and the age of the well;
4. Significant potential contaminant sources within the source water area;
5. Relationship of the well to surface waters.

Wisconsin's existing Vulnerability Assessment Program will serve as starting point for this component of the SWAP. The Vulnerability Assessment Program was developed in 1991 and 1992 to eliminate the expense of unnecessary monitoring. Assessments for all community and non-transient non-community public water systems are performed every three years. The assessment consists of an inventory of potential sources of contamination within a delineated area and an evaluation of well construction, pesticide susceptibility, industrial chemical use, and vulnerability to volatile organic compounds, ethylene dibromide, asbestos and coal tar (See Appendix U). As discussed in Section 2.10, the inventory list of potential sources of contamination used for the vulnerability assessments was updated for the SWAP to include a wider, more complete, array of potential sources of contamination. Vulnerability assessments are being conducted on the following schedule: 1998 - municipal systems; 1999 - other than municipal systems; 2000 - non-transient non-community systems; 2001 - municipal systems, 2002 - other than municipal systems. Vulnerability assessments are not currently required for transient non-community systems and so are not included in the schedule. For the SWAP, however, susceptibility determinations will be conducted for transient systems throughout the SWAP period and will be completed by May, 2003.

Figure 1 outlines the susceptibility determination process to be used for SWAP assessments. This process includes a process for determining if a hydrogeological barrier exists. The hydrogeological barrier determination will be a required step in the susceptibility determination for all systems in karst, gravel/cobble, or fractured bedrock settings. We will require that the time of travel used in these determinations be that time period that EPA decides is appropriate for protection of public health from pathogens in the Groundwater Rule.

Though not directly addressed by the SWAP, Wisconsin recognizes that the presence of naturally occurring inorganics or radionuclides in some geologic units may present a threat to some drinking water quality. When information is available on these contaminants it will be included in the assessment results.

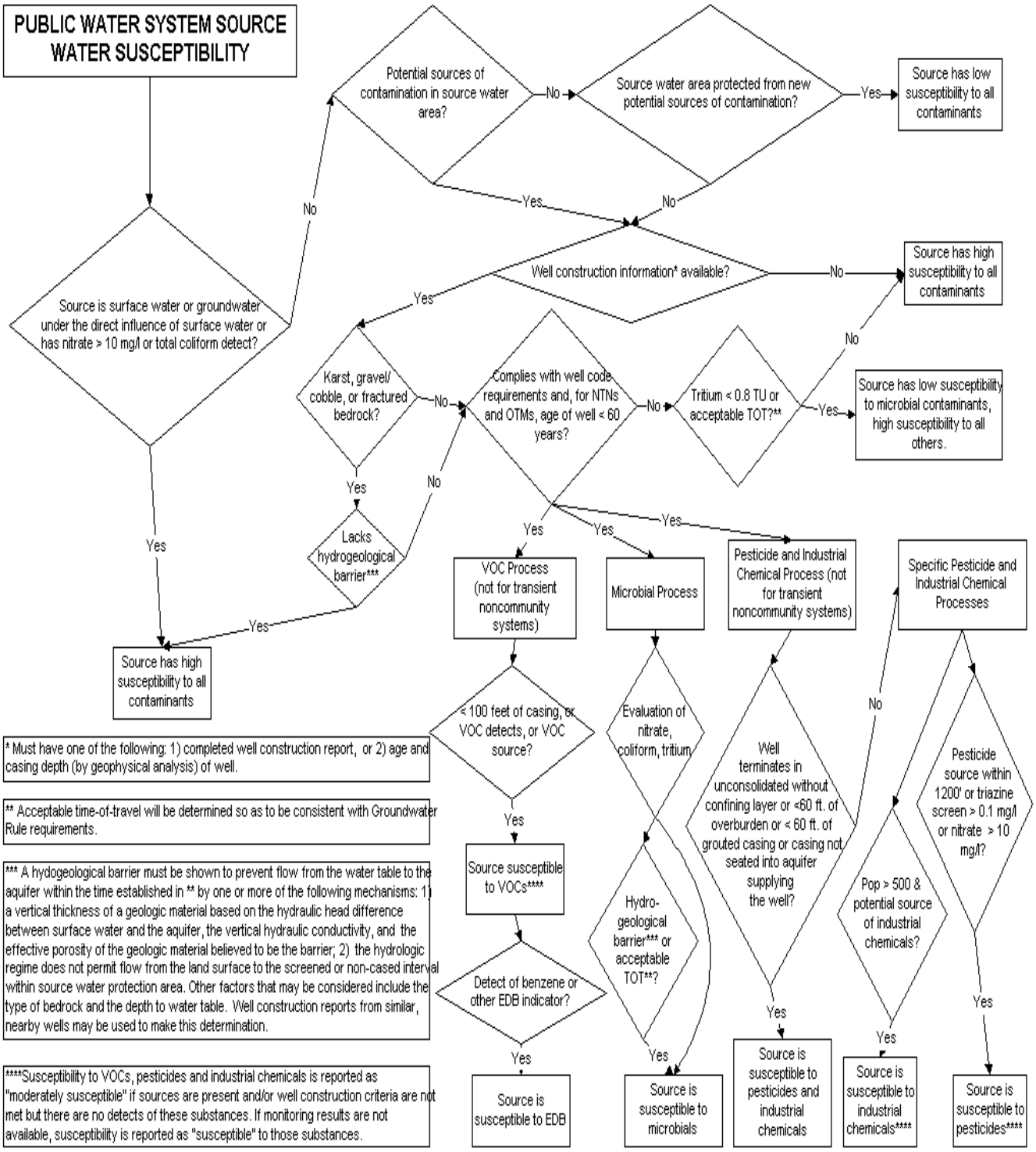

Figure 2 – Susceptibility determination process

Community and Non-transient Non-community Systems

The state has expanded the range of factors considered in the vulnerability assessment process for use in making susceptibility determinations (see Figure 1). In addition to the criteria listed in Figure 1 the following additional factors may be considered in making susceptibility determinations and subsequent vulnerability assessments .

Physical, Biological, Chemical, Hydrologic and Hydrogeologic Characteristics
1. thickness and continuity of confining unit
2. depth to bedrock
3. type of bedrock (not for wells screened in unconsolidated formations)
4. depth to water table
5. permeability of soil/surficial deposits if available
6. presence of naturally occurring inorganics or radionuclides in geologic units

Significant Potential Sources of Contamination
1. Number of significant potential sources of contamination of all types within SWPA
2. Number of microbial contaminant sources within 200 ft. of well
3. Proximity of well to surface water

Well Integrity
1. Compliance with NR 811/812 construction requirements (Unofficial text from these Administrative Codes is available on the worldwide web at: www.legis.state.wi.us/rsb/code/nr/nr800toc.html)
2 Condition of casing

Monitoring Results
1. Raw Water Quality Monitoring Data
2. Tritium, oxygen isotope, chlorofluorocarbon or other age dating analyses if available

The susceptibility analysis will be reported to each system and to the public in a narrative format covering the following topics:

1. Description of the hydrogeologic setting
2. Description of the system integrity
3. Summary of the significant potential sources of contamination
4. Review of water quality data
5. Suggestions for management activities

The results of the susceptibility analyses will be reported to the owner/operator of each system with a map of the source water area with the potential sources of contamination indicated within and a narrative describing the information listed above. The intention is to present the information to systems clearly and without bias for local decision-makers to evaluate and use for source water protection. The WDNR is not proposing a ranking or rating scheme. No detailed risk assessment will be conducted. However, the WDNR will provide assistance for systems/communities to prioritize potential sources of contaminants within their source water area. This assistance will be sculpted to each community's/system's needs. Each community/system must consider: 1) proximity of individual significant potential contaminant sources to each well or intake, 2) existing monitoring results, and 3) vulnerability assessment results.

An example susceptibility determination narrative for the hypothetical city of Badger City has been produced below to show how our SWAP process, analyses, and susceptibility determination will be

communicated to the public. We feel that this process will provide an objective and consistent methodology for decision-making regarding contamination susceptibility. The determination will serve as a "stand alone" piece for general information or can be combined with information on other factors to determine or recommend appropriate management measures. Not all of the information included in the Badger City example will be available for all systems. Tritium analysis will be available at a cost for systems to determine microbial susceptibility in cases of noncompliance with well construction requirements or absence of a hydrogeological barrier. Drinking water monitoring results for contaminant levels that are below drinking water standards may be incomplete. Geologic, aquifer recharge and groundwater flow direction information will vary in accuracy and may be incomplete.

Susceptibility determination for Badger City (fictitious city and data)

Hydrogeologic Setting and well integrity: Unconsolidated sand and gravel, clay alluvial deposits, and glacial clay till deposits blanket the entire source water assessment area and are approximately 150 feet thick at the well site. The well is 475 deep and is cased 175 feet into the Upper Cambrian sandstone bedrock. The well draws water from 300 feet of open interval in the sandstone aquifer. Pre-Cambrian crystalline bedrock underlies the sandstone aquifer at 475 feet in depth. The well is in compliance with NR 811 well requirements. Though there are likely to be lenses of clay deposits that prevent vertical groundwater flow in some localized areas in this type of setting there is no confining unit that can prevent the downward migration of contaminants into the aquifer. The aquifer is recharged approximately 3 to 6 inches of precipitation per year. Tritium analysis indicates that most of the water reaching the well has been out of contact with the atmosphere for at least 55 years. Groundwater flow direction is generally from north to south, with a local flow component to the southwest. This means that any major groundwater contamination north or northeast of Badger City has the potential to impact the public drinking water supply.

Potential Sources of Contamination: (Figure 2) Eighteen significant potential sources of contamination exist in the 1200-foot radius source water assessment area. These sources include agricultural farming, manure storage, pesticide storage, underground fuel storage tanks, road salt storage, septic tanks and drainfields, a rail yard, and an abandoned landfill. All of these sources are off the property controlled by the city. The land use in the source water assessment area is approximately 25% urban/developed, 55% agricultural, 10% forest, 5% wetlands, 5% shrubland.

Water Quality: Nitrate contamination is present in private wells surrounding Badger City but has not yet been problematic for the city's water supply. Nitrate levels remain below the 10 mg/l drinking water standard though they have increased in recent years from < 1 mg/l to 3 mg/l in 1999. Other contaminants have not been found in the city's water supply.

Source Water Susceptibility and Protection: Water quality monitoring results, well construction characteristics, well code compliance and local geology indicate that the Badger City well is not highly susceptible to contamination. The well is not susceptible to microbial contaminants due to the long travel time for water to reach the well from the land surface. However the presence of pesticide and VOC sources within the assessment area and the lack of a confining layer make this well moderately susceptible to pesticides and VOCs. The rising nitrate levels underscore this susceptibility. Protection activities should focus on obtaining additional information on pesticide and VOC sources in the area to evaluate their risk. The city may want to consider monitoring for pesticides and herbicides because of the use of these chemicals near the well. Other efforts should include looking for improperly abandoned wells or other features that may provide direct pathways for contamination to enter the aquifer.

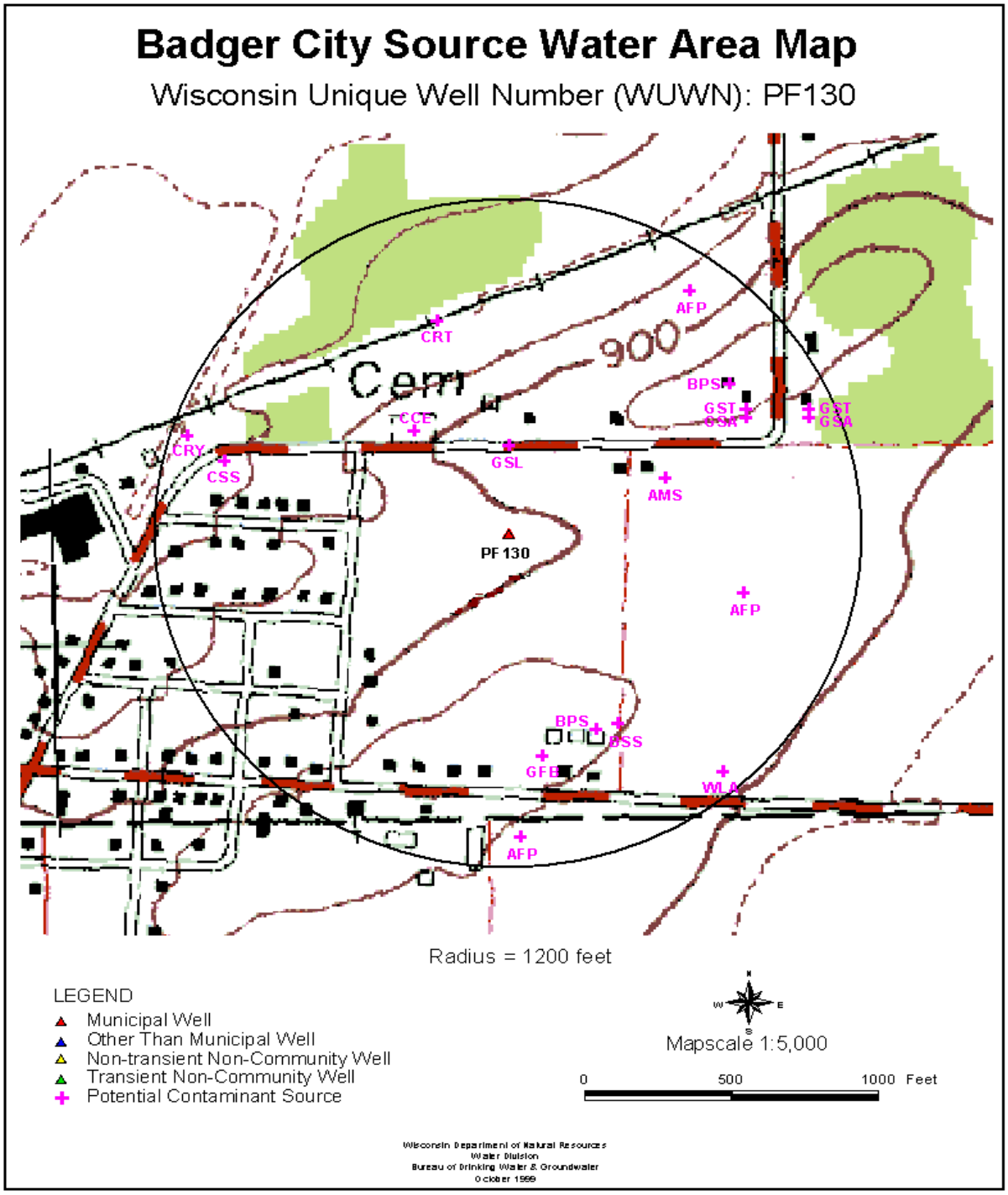

Figure 2 – Map of well location, assessment area, and potential contaminant source locations for fictitious Badger City. Potential contaminant sources are identified by three-letter codes from Appendix N.

Transient Non-community Systems

A more limited approach will be used for determining transient non-community wells' susceptibility. For these systems, pathogens and nitrate will be the focus of the susceptibility analysis. The VOC, pesticide and industrial chemical processes of the susceptibility determination process detailed in Figure 1 do not apply to transient non-community systems. We are currently working with the state of Minnesota to develop a common strategy to determine susceptibility for these systems. The strategy will be based on the premise that for a system not to be susceptible one or more of the following conditions must be present:

- Geological barriers
- Mitigation of hydraulic conditions related to pumping, well construction, and aquifer composition
- Absence of potential sources of pathogens and nitrate in the recharge area

Where well construction reports are not available, a well must not have any potential sources of pathogens or nitrate in the recharge area and that area must be protected from new sources for that well to have "low susceptibility". Area-wide assessments (see Section 2.15) may be conducted for wells where insufficient information exists to make the above determination. Area-wide assessments will rely on resource evaluation by non-well-specific data (e.g., several well construction reports for nearby wells indicating a shallow, continuous confining layer). Monitoring results will also be consulted in determining the susceptibility of these systems. Efforts will be made to coordinate the assessments with Groundwater Rule susceptibility determinations. If possible, only one susceptibility determination will be made for both the SWAP and the Groundwater Rule.

2.14 Susceptibility Determinations for Surface Water Systems

Because surface waters are unprotected by geologic materials, these waters may rapidly transport contaminants to public water systems. The SDWA recognizes the high susceptibility of surface waters and the public water systems that use them by requiring treatment and monitoring for these drinking water sources that are not required for groundwater sources. Wisconsin considers all surface water systems to have high susceptibility to all contaminants and has addressed that risk by requiring treatment for all systems using surface water. Public input on the SWAP from the AHAC and others in Wisconsin has supported minimal assessments for surface water systems so as not to waste resources that could be used to assess groundwater systems. This shows an appreciation of the difficulty of assessing the potential for contamination from the approximately 8 million acres of land area in surface water system source water assessment areas. To make efficient use of our source water assessment funding we have produced a streamlined surface water system assessment strategy with a goal of providing a base level of unbiased information to systems and the public to evaluate and use for source water protection.

Public and AHAC input showed interest in maximizing the use of existing information to prevent duplication of effort in producing the assessments. This is consistent with WDNR goal of integrating various program data so that it may be useful to more than just one program. Consequently, susceptibility determinations for surface water sources will focus on accessing available information including:

- Statewide potential contaminant source information
- Potential contaminant sources in groundwater system assessment areas

- Resource characterization including land use and watershed studies
- Proximity of intakes to stream discharges
- Magnitude of stream discharges
- Water quality monitoring data
- Input from water supply and watershed professionals

The information will be collected and interpreted in an objective manner. Professional judgment will be used when necessary. Specific recommendations for watershed protection will be made for each system. A qualitative determination of relative susceptibility will be made but a priority ranking will not be made.

Susceptibility to contamination will be assessed differently for each of the two distinct types of surface water system sources in the state: 1) Great Lakes (15 systems), and 2) Lake Winnebago and Rainbow Lake (5 systems). Assessment methodology for these two categories of systems is described below.

For the 15 systems that use Great Lakes sources the evaluation will be guided by the Assessment Protocol for Great Lakes Sources (Appendix R). WDNR staff has participated in the development of this protocol and will continue to do so. As of October 1999, the protocol is nearly complete. Wisconsin is planning two pilot projects to test the protocol by January, 2001.

Resource characterization will be conducted on the delineated source water areas. The purpose of conducting a resource characterization is to obtain a generalized understanding of the watershed's physical characteristics. The results of the resource characterization analysis will be used to evaluate the relative sensitivity of the source water to contamination. In order to characterize the condition of the water resources within a source water area, a variety of resource characteristics will be evaluated.

Lake Winnebago and Rainbow Lake

The Lake Winnebago watershed is an inland waterway that has been subject to extensive water quality testing, modeling, evaluation and management. Extensive efforts and resources have been devoted to improving water quality in Lake Winnebago. Public participation in water resource management decisions in the Fox-Wolf River Basin has been high. The WDNR will conduct a literature review to obtain the most current information on the resource and approved WDNR basin water quality management plans will be reviewed. Technical reports published by Northeast Wisconsin Waters for Tomorrow, Fox-Wolf Basin 2000 and other groups will be reviewed. The Lake Winnebago Comprehensive Management Plan and the Lower Green Bay Remedial Action plan will be reviewed.

There has been extensive monitoring of the resource to support the aforementioned management plans. In addition, monitoring has been conducted as part of WDNR's implementation of the SDWA and Clean Water Act. Chemical, physical and biological data will be used to characterize the delineated SWAP area. Data is available in a variety of formats, electronic and paper files. Available data to be reviewed includes, but is not limited to:

- Test results from treated drinking water and untreated source water conducted by the system owner or other agencies or investigators. Inorganic, organic, synthetic organic, radionuclide, bacteria, virus, parasite, algae, microtoxin and other test results are available.
- Ambient Water Chemistry
- Sediment Chemistry
- Habitat Evaluations
- Use Attainment Assessments

Other information used to characterize the Lake Winnebago resource may include:

- Hydraulics and transport characteristics
- Proximity of stream discharges to intakes
- Magnitude of stream discharges
- Proximity of intakes to wastewater treatment plant and industrial wastewater discharge points
- Potential for surface runoff as indicated by soil characteristics, watershed size and shape, topography, slope and other factors
- Stream length, stream gradient, rainfall, runoff and seasonal variations in time of travel to characterize movement of water through the watershed.

The purpose of the resource characterization will be to assess the susceptibility of public water systems located on Lake Winnebago to contaminants of concern.

Rainbow Lake is a small lake with a small watershed that provides drinking water to one small municipal system. This assessment will be done in the same format as those done for systems on Lake Winnebago, though on a much smaller scale.

Lake Michigan and Lake Superior

Resource characterization for public water systems drawing from Lake Michigan and Lake Superior will be conducted differently. Intakes will be evaluated for shoreline impacts by examining raw water quality parameters such as turbidity and coliform peaks. If found not to be impacted, available data on Lake Michigan or Lake Superior as a whole will be used. Proximity of intakes to stream discharges will be evaluated. The magnitude of stream discharges in the delineated SWAP areas will be assessed and the closest locally discharging watersheds to the intake/intake cluster will be characterized. Applicable WDNR approved basin plans and remedial action plans will be reviewed. Results from untreated source water quality analyses and historical ambient water chemistry data will be reviewed. The purpose of the resource characterization will be to assess the relative sensitivity of the Lake Michigan/Lake Superior intakes to the transport of contaminants of concern. An emphasis will be placed on determining the relative vulnerability of each intake/intake cluster to pathogenic microorganisms. The results of the susceptibility analyses will be reported to the owner/operator of each system with a map of the source water area with the potential sources of contamination indicated within and a narrative describing the information listed above. The intention is to present the information to systems clearly and without bias for local decision-makers to evaluate and use for source water protection. The WDNR is not proposing a ranking or rating scheme. No detailed risk assessment will be conducted.

To show how the process, analyses and susceptibility determination will be communicated to the public the following example assessment for a fictitious system drawing water from Lake Winnebago has been provided.

Example Source Water Assessment for the City of Laketon (fictitious city and data)

Hydrologic Setting: The City of Laketon obtains its drinking water directly from 2 intakes located on the east side of Lake Winnebago, part of the Lake Winnebago system. The intakes are located 1500 and 1300 feet offshore at depths of 12 and 10 feet respectively.

The Lake Winnebago system is composed of Lakes Winnebago, Butte des Morts, Winneconne and Poygan, plus their main tributary waters of the Upper Fox and Wolf Rivers. The system comprises 17% or the state's surface water acreage. There are 5,432 stream miles. The lakes average 7 feet in depth, and receive water from 6,000 square miles of watershed. Two major river basins, the Upper Fox and Wolf, drain into Lake Winnebago. These watersheds include all or parts of 18 counties and consist of 35 watersheds. At 137,000 acres, Lake Winnebago is the state's largest inland lake. Hydraulic data indicate that, due to its shallow depth and multiple inlets, the lake is well mixed.

Water levels are controlled by dams located at each of the two outlets of Lake Winnebago at Neenah and Menasha. These dams date back to the 1850's and raise the water levels of the lakes 2.5 – 3.0 feet to form what is known as the Winnebago Pool. The dams were originally constructed to manage water levels for commercial navigation, as the system was an important trade and exploration route for early settlers. Lakes Butte des Morts, Winneconne and Poygan were formerly described as river marshes rather than lakes, and vast shallow bays and marshes bordered Lake Winnebago. Increases in water levels and subsequent management of water levels for navigation and commerce, water pollution and other factors resulted in the loss of tens of thousands of acres of wetland habitat. Since then, shorelines have been eroded by wind, water, and ice action.

Lake Winnebago lies in the Southeast Glacial Plains ecological landscape of the state. Average annual rainfall is approximately 32 inches. Its watershed extends into the Northeast Hills, Northeast Plains and the Central Sand Hills ecological landscapes. Over 30 named soil types are present. Topography varies widely in the watershed. Average stream gradient on the mainstem Wolf River is 4.8 feet per mile. Average stream gradient on the mainstem Upper Fox River is 3.3 feet per mile.

Potential Significant Contaminant Sources: (A map or maps showing locations of the following will be part of the assessment results)
Land use – urban/developed, agricultural, grassland, forest, open water, wetlands, barren, shrubland
Large animal feedlots – over 300 animal units
Landfills – licensed and available unlicensed
Hazardous waste generators - large quantity
Superfund sites - all
Emergency response and repair sites (LUST and spills) – best available
Potential contaminant sources within groundwater system SWAP areas
Transportation network - the number of miles of train tracks, primary roads, and secondary roads, the number of miles of these potential sources within 100 feet of waterways, and the number of stream crossings of these potential sources within the watershed

The land use in the source water assessment area is approximately 5% urban/developed, 55% agricultural, 20% forest, 15% wetlands, 5% shrubland. Agricultural land use in the basin include feed lots, pastures, manure storage areas. Basin plans indicate that agricultural practices in the basin include nutrient and pesticide application, uncontrolled access by cattle to streams, and improper spreading practices. Additionally, failing septic systems, urban runoff from lawns and pet waste directly routed into the waterways through storm sewers, failure of sewage treatment facilities, industrial discharges, and construction site runoff all impact surface water quality.

Water Quality: (will include a table of summarized water quality results from analysis of ambient water chemistry, treated drinking water, untreated source water, sediment chemistry, and habitat evaluations)

These results show that the Winnebago Pool is hyper-eutrophic in nature due to the excessive nutrient and sediment loading. Pesticide use in the basin has contributed synthetic organic compounds to the

waters. In addition, occasional commercial and industrial pollutants cause fish dieoffs and pose potential water quality problems.

For Clean Water Act reporting, the WDNR evaluates waters by the waterbody's ability to support its designated or beneficial uses. The designated use of a waterbody identifies the type of aquatic community the water should be able to support and the types of functions it is expected to provide, such as a trout fishery, if it were not affected by other influences. Chemical, physical (habitat, morphology, etc.), or biological information, or direct observation and professional judgment are among the information resource managers use for determining the uses supported and the designated use.

A waterbody's existing use indicates the biological use that the stream or stream segment currently supports. This is based on the current condition of the surface water and the biological community living in that surface water.

COLD Cold Water Community; includes surface waters that are capable of supporting a community of cold water fish and other aquatic life or serving as a spawning area for cold water fish species.

Class I - high-quality stream where populations are sustained by natural reproduction;

Class II - stream has some natural reproduction but may need stocking to maintain a desirable fishery;

Class III - stream has no natural reproduction and requires annual stocking of legal-size fish to provide sport fishing.

WWSF Warm Water Sport Fish Communities; includes waters capable of supporting a community of warm water sport fish or serving as a spawning area for warm water sport fish.

WWFF Warm Water Forage Fish Communities; includes surface waters capable of supporting a abundant, diverse community of forage fish and other aquatic life.

LFF Limited Forage Fishery (intermediate surface waters); includes surface waters of limited capacity due to low flow, naturally poor water quality or poor habitat. These surface waters are capable of supporting only a limited community of tolerant forage fish and aquatic life.

LAL Limited Aquatic Life (marginal surface waters); includes surface waters severely limited because of low flow and naturally poor water quality or poor habitat. These surface waters are capable of supporting only a limited community of aquatic life.

The biological use that the stream or stream segment could achieve through proper management of controllable pollution sources is the potential use, and may be the same as the existing use or it may be higher. Streams are designated according to how they support the potential use.

Fully Supporting A stream or stream segment's existing biological use is the same as its potential biological use.

Fully Supporting/Threatened A stream or stream segment's existing biological use is the same as its potential biological use but there is a *clear and imminent* threat to the existing use remaining

at its current level of biological productivity and ecological health. This threat could be due to actions likely to occur on or to the stream and/or in the watershed, such as:

- Rapid commercial, residential, and/or industrial development in the watershed,
- The advent of large-scale industrial operations in the watershed,
- Planned or active channel modifications that have been, or will be permitted, or cannot be regulated under existing state or federal rules (i.e., drainage districts).

Partially Supporting A stream or stream segment's existing biological use is the same as its potential biological use, except that implementation of management practices could enhance the overall ecological health of the biological community. Management practices in this category include modification of hydroregimes to reduce the impact of dam operations on the biological community.

Not Supporting When a stream or stream segment's existing biological use is less than its potential biological use.

The majority of streams feeding Lake Winnebago system are categorized with the existing use of WWSF and a potential use of WWSF. However, land use activities in the watershed have somewhat impaired the surface water quality. Thus generally, waters feeding Lake Winnebago are classified as partially supporting their potential uses. The level that existing biological uses support potential uses for the 5,432 stream miles of water bodies in the Lake Winnebago is summarized in the following table (table omitted in example).

Susceptibility

Due to its use of a surface water source, the City of Laketon's susceptibility to contamination is very high. Laketon and all surface water systems in Wisconsin are required to treat drinking water to alleviate risks of contamination in drinking water. Due to the well-mixed characteristics of Lake Winnebago, the City of Laketon's intakes are not any more or less susceptible to contamination than are the other systems drawing water from Lake Winnebago. An inventory of major potential contaminant sources and land uses in the extensive watershed revealed numerous potential sources of contamination, both point source and non-point sources. Based on water quality monitoring results at the treatment plant, the City of Laketon is particularly susceptible to sources of bacteria, nitrogen, and pesticides.

Watershed Protection

Source water protection efforts should be focused on controlling the following potential sources of contaminants in the watershed: 1) animal wastes from feed lots, pastures, manure storage areas, uncontrolled access by cattle to streams, and improper spreading practices; 2) failing septic systems; 3) applied or natural nutrients and pesticides from agricultural fields; 4) urban runoff from lawns and pet waste directly routed into the waterways through storm sewers; 5) failure of sewage treatment facilities; 6) industrial discharges; 7) construction site runoff.

2.15 Area-Wide Assessments

When multiple water supply systems are found to share uniform conditions that allow for common determinations of susceptibility, the resulting assessments will be called "area-wide assessments". Such assessments may be appropriate where a protective geologic layer is thought to be present throughout an area where two or more wells exist or where intakes are located close together in the same surface waterbody. Area-wide assessments are most likely to be used for transient non-community wells which typically pump low volumes of water and should have minimal potential to draw pathogens through a protective layer. Here, an assessment covering multiple systems may be warranted if it can be demonstrated for each well that it is: 1) pumping from the protected aquifer and 2) properly constructed so the well column does not present a pathway for contaminants to enter the well. The WDNR will encourage systems evaluated with area-wide assessments to share source water protections efforts.

Chapter 3 - Making the Assessment Results Available to the Public

3.1 Contents of Assessments

Completed source water assessment reports for each water supply system will contain:

- A map for each well or intake or group of community wells or intakes showing the source water area delineated for each well or intake and the location of existing or potential contaminant sources within each area. The types of contaminant sources will be identified by a three-letter code.
- A contaminant inventory form that identifies the types of contaminant sources within each area.
- A description of the methodology used in the susceptibility analysis for each public water supply system.
- A narrative describing the susceptibility for each public water supply system well or intake.
- Recommendations for protecting the water system from contamination.

The WDNR does not anticipate many requests for "all of the available information" collected during each assessment, but believes that WDNR staff should be in a position to provide this information if it is requested. Anticipated improvements in data management and GIS capabilities should make the information readily accessible. If someone asks for all the information, we intend to tailor a report to meet their needs. For information beyond standard assessment reports there may be a charge to cover reporting costs.

3.2 Map Preparation

As part of reporting assessment results, the state will prepare maps showing the delineated assessment areas and locations of contaminant sources. Maps may be created using various features available in the GIS format such as roads, highways, railroads, airports, waterbodies and political boundaries. Alternatively, maps may be created using digital raster graphics, or scanned topographic quadrangle maps at a 1:24,000 scale. These are scanned images of United States Geological Survey topographic maps that can be overlaid with delineations, wells and contaminant sources. Maps prepared using digital raster graphics will show greater detail than regular GIS maps and would include a large variety of natural and manmade features. Another option that may be available by the time the data is available for map development is the use of digital orthophotos, which are digital images of an aerial photo, and like digital raster graphics may be overlaid with other data. Use of digital orthophotos will result in more detailed and possibly more up-to-date maps than the previous two options. Digital orthophotos are not currently available for the entire state, but may be available statewide within a useful time frame (1-2 years). The state proposes to use the digital orthophoto coverage if available statewide by the time the assessments are completed. If digital orthophotos are not available, we propose using a combination of digital raster graphics and GIS data layers.

3.3 Review of Assessments

The AHAC has agreed to convene on a semiannual basis, as long as they deem necessary, to review the progress of the SWAP as it is implemented. A local government representative will be invited to these meetings at which the WDNR will present assessment results in various formats to get input on how best to present the results to the local community.

3.4 Availability of Assessments and Followup

The WDNR proposes to make the results of a community's assessment available as soon as it is completed. The state will accomplish this goal by reporting the availability in the Wellhead Protection Newsletter, issuing press releases and working with the media. A copy of the assessment, including maps, will be sent to the community's water supply operator. A shorter version of the report will be put on the WDNR's Source Water Protection web site. It is WDNR's long-term goal to put all assessment information on the web site. Paper copies of the report will also be made available. If there is interest, the information will be made available by county.

National Primary Drinking Water Regulations S141.153 (b) (2) requires that *"If a source water assessment has been completed, the report must notify consumers of the availability of this information and the means to obtain it. In addition, systems are encouraged to highlight in the report significant sources of contamination in the source water area if they have readily available information. Where a system has received a source water assessment from the primacy agency, the report must include a brief summary of the system's susceptibility to potential sources of contamination, using language provided by the primacy agency or written by the operator."* To help systems meet these requirements the WDNR will provide each system with 1) an explanation of the goal and timetable of the SWAP, 2) an estimate of when the assessment will be available and, 3) a brief summary of each system's susceptibility to potential sources of contamination when available. An example of the brief summary of each system's susceptibility to potential sources of contamination to be provided to each system follows.

Example consumer confidence report summary of susceptibility to potential sources of contamination for Badger City (fictional)

Water Quality monitoring results, well construction characteristics and well code compliance indicate that the Badger City well is not highly susceptible to contamination. However the presence of pesticide and VOC sources within the assessment area and the lack of a confining layer make this well moderately susceptible to pesticides and VOCs. More information on the susceptibility of this public water system to contamination may be obtained by contacting the Badger City Water Utility at (000) 000-0000 or by viewing the source water assessment results on the worldwide website at http://www.dnr.state.wi.us/org/water/dwg/swap/BadgerCity.HTM

WDNR staff will be available to explain the assessment process and results as needed. However, after the assessment is completed and provided to the water systems, the WDNR will direct inquiries from the public to the systems so that they can be the primary source of information. This community interest will be the basis for source water protection efforts undertaken by the community or system.

Since the information gathered during the source water assessment process makes up much of the information that is needed for a wellhead protection plan, it is hoped that many communities will take advantage of this opportunity to complete the WHP planning process. Where there is community interest, the WDNR will work with communities to determine the most appropriate steps to take to protect their water supply (see Section 5.3).

Chapter 4 - Program Implementation

4.1 Extension Request

Wisconsin will have two years, with a possible 18 month extension, to complete source water assessments once its program description is approved by the EPA. Wisconsin requests the 18 month extension in order to complete source water assessments for public water systems for the following two reasons: 1) there are approximately 11,900 systems that use groundwater in the state; and 2) source water areas for the 20 systems that use surface water include over 12,500 square miles of land area. Work load and logistical problems inherent in doing assessments on this scale necessitate the request for an 18 month extension. Therefore the proposed timeline for completing the assessments is based on a completion date of May 6, 2003, 3 ½ years from the expected approval date of November 6, 1999.

4.2 SWAP Funding

States can set aside up to 10 percent of the total annual federal capitalization grant for federal fiscal year 1997 for the required delineations and assessments. This set-aside is available only in federal fiscal year 1997 and must be obligated within four years. Any funds not spent for delineations and assessments are automatically returned to the Drinking Water State Revolving Fund. Wisconsin has set aside the full 10 % ($4,154,640) of the federal fiscal year 1997 capitalization grant for the SWAP.

4.3 Implementation Timeline

Until the SWAP plan is approved, it is uncertain when the various parts of the SWAP will be implemented. There is additional uncertainty because the WDNR has yet to obtain approval to hire all staff to take on the workload associated with the SWAP. However, many of the tasks below have been started and are proceeding concurrently. Assuming that the SWAP plan is approved by EPA as proposed in this plan, and approval is granted for SWAP staff, the state will follow this general timeline:

1. Assemble existing information
   - Compile potential contaminant sources inventories through the vulnerability assessment program by December 2000 for non-transient non-community wells, December 2001 for municipal wells, and December 2002 for other-than-municipal community wells.
   - Locate, delineate, and inventory potential contaminant sources for transient non-community systems by December 2002.
   - Identify and compile existing data of potential contaminant sources from WDNR, other state agencies, federal agencies, local governments, and planning organizations for use in surface water system assessments by December, 2002.

2. Implement public participation process
   - Obtain, compile, and address input from interested members of the public and the AHAC in an ongoing process that will be focused in the short term on coming to a consensus on the state SWAP plan by February, 1999.
   - Continue meeting with the AHAC and other stakeholders to review SWAP progress on a semi-annual basis or until the AHAC decides to dissolve itself.

3. Prepare Source Water Assessment Program plan and submit to EPA by February 6, 1999

4. Complete groundwater system delineations, resource characterizations, and assessments
   - Locate and map all public water supply wells by December, 2002
   - Delineate source water areas by the following proposed methods:
     - Municipal wells: baseline calculated fixed radius delineations based on 5 years of average annual pumping with a minimum radius of 1200 ft. Delineations were completed during the summer of 1998 and will be improved if necessary in 2001. A process for completing advanced delineations for municipal systems where calculated fixed radius delineations are not appropriate will run continuously through the SWAP implementation.
     - Other-than-municipal community and non-transient non-community wells: 1200-foot fixed radius delineations will be completed during the summers of 2002 and 2000, respectively.
     - Transient non-community wells: 200-foot fixed radius delineations will be completed by Spring, 2002.
   - Complete inventories of potential contaminant sources for groundwater system source water areas by December, 2002.
   - Complete resource characterizations, including those for regional groundwater flow modeling, throughout the SWAP implementation period.
   - Map source water areas, potential contaminant sources and natural resource characteristics in a GIS for all groundwater systems by July, 2002.
   - Complete susceptibility analyses by May 6, 2003.

5. Complete surface water system delineations and assessments
   - Locate and map all surface water public water supply intakes.
   - Delineate watershed boundaries as source water areas for each surface water public water supply intake by July 1, 2000.
   - Great Lakes pilot projects completed by January, 2001.
   - Complete resource characterization by October 1, 2002.
   - Establish relationships with surface water programs to facilitate cooperation by December, 1999.
   - Map source water areas, natural resource characteristics, and contaminant inventories for all surface water systems in a Geographic Information System by October, 2002.
   - Complete all susceptibility determinations by May 6, 2003

6. Provide assessment results to the public water systems and the public
   - Provide all assessment results to public water systems when they are completed. All assessments will be completed by May 6, 2003.
   - All assessments will be summarized on the Source Water Protection web page as they are completed.

4.4 Program Progress Reporting

During implementation of the SWAP there are numerous opportunities to report progress to EPA. We propose to make assessment results available to EPA when we provide them to public water systems. The State will report progress for both surface and ground water system assessments through the wellhead protection biennial report and, if requested, through SDWIS. Additionally, we will provide progress reports to EPA Region 5 on SWAP implementation when requested. The WDNR will also meet with

EPA Region 5 semi-annually to discuss the progress of the SWAP.

State agencies will need to coordinate closely with each other, and with other stakeholders when implementing the SWAP. WDNR staff will hold meetings with representatives of other state agencies, federal agencies, and local stakeholders to ensure communication and coordination during the SWAP implementation. This will occur through the GCC and its subcommittees, the WDNR Source Water Protection Standing Team, the two technical advisory committees assembled for the SWAP, and other forums. The WDNR will promote sharing of information and resources for common goals.

4.5 Updating the Assessments

There will be a need to update assessments in response to emerging regulatory flexibility and changing information that may affect delineations, resource characterizations, contaminant inventories, and/or susceptibility analyses. However, after May 6, 2003 federal funding will no longer be available for source water assessments. The state would like to maintain the utility of the assessments but cannot guarantee a set schedule for updating all aspects of them. We propose to update assessments as much as possible on the vulnerability assessment schedule. Currently the state does vulnerability assessments on a 3 year schedule (i.e. municipal systems in 1998, other-than-municipal systems in 1999, and non-transient non-community systems in 2000, municipals in 2001…). Assessments for transient non-community systems will be updated only after larger systems are updated. WDNR suggests that EPA seek authority for future SWAP setasides for updating assessments.

4.6 Working with Other States, Federal and Tribal Lands, and the EPA

The municipal systems serving the cities of Marinette and Superior are the only public water supply systems in Wisconsin that have source water areas outside of the state (in Michigan and Minnesota respectively). The WDNR will work with agencies within those two states to obtain assessment information on these areas. Preliminary contacts with these agencies indicate a willingness to exchange information to assure satisfactory assessments for these two systems. Wisconsin will share existing information with states (e.g. Illinois, Minnesota, and Michigan) that request it for areas that contribute water to out-of-state public water systems.

The state will share any information relevant to source water assessments with other states that request it for the purpose of doing assessments. In turn, we will ask that other states provide us with available information that is relevant to source water assessments for systems in Wisconsin.

Region 5 EPA will encourage cooperation among states to accomplish compatible and complementary source water assessments in watersheds that include more than one state. While these efforts are voluntary on the part of the states, the EPA has offered to facilitate discussions and provide regional assistance. The state has contacted neighboring states regarding interstate assessments and has found that they are cooperative in providing available information needed for assessments and so has not requested federal assistance in coordinating assessments with other states.

The WDNR will conduct source water assessment for federal facilities. The WDNR will cooperate with US EPA Region V in their efforts to work with National Park Service and other facilities to gather information about water supply wells at these facilities.

Tribal lands are outside of the state's jurisdiction. Therefore the state will not apply its SWAP to those lands. However, the state will share any information that may be relevant to source water assessments being conducted on tribal land to entities that request it. The state, in turn will request that tribal authorities share available assessment information on lands contributing water to public water systems in the state.

4.7 Contingency Plans

Contingency plans are relied on to help system operators prepare for a loss of integrity to the drinking water system. A contingency plan is defined as the development and implementation of both long- and short-term drinking water supply replacement strategies for supplying safe drinking water to the consumer in the event of contamination or physical disruption. Wisconsin has had a contingency plan for all public wells since October, 1984. The contingency plan, entitled "Annex N - Emergency Water Supply Plan of the Wisconsin Emergency Operations Plan" was cooperatively developed by the U.S. Army Corp. of Engineers, Wisconsin Division of Emergency Government, and the WDNR and was submitted to the EPA during that year.

Wisconsin's WHP program requires an additional contingency plan for wells installed after May 1992 and encourages communities with older wells to develop a complementary contingency plan for use if their water supply becomes contaminated. Two national organizations and the EPA have developed training materials and a template for contingency plan development. These templates have not been finalized nor adopted by the EPA or the WDNR at this time. However, it is our intent to support the use of this type of material and to identify model contingency plans for use by communities.

Chapter 5 - Source Water Protection

Wisconsin is committed to using the assessments to promote source water protection with existing active environmental and public health protection programs. The state's source water protection efforts will be largely carried out through it's Wellhead Protection (WHP) program.

5.1 Wellhead Protection Program Overview

Wisconsin's WHP program was approved by the EPA in 1993 and contains both voluntary and regulatory components. All new municipal wells installed after May 1, 1992 must have an approved WHP plan before that well can be placed in service. Section NR 811.16(5), Wis. Adm. Code, contains the required elements of a WHP plan for new wells. As of November 1, 1998, 94 plans have been approved covering 137 wells. WDNR will continue the regulatory program for all new wells.

The voluntary component of Wisconsin's WHP program applies to all municipal wells installed prior to May 1, 1992. The WDNR promotes and encourages development and implementation of a WHP plan for communities with older wells as a proactive step to protect these wells from contamination. However, there is no requirement that a WHP plan be prepared for older wells or that a plan be submitted to the for review or approval. The WDNR and other agencies have worked on several fronts to promote voluntary wellhead protection efforts by communities. Those efforts include:

1. Publications - The WDNR has produced several publications that have been widely distributed to assist communities and consultants in preparing plans. "Wellhead Protection Plans for Municipal Wells - A Template" describes what level of detail should be provided in a WHP plan for a new well. Two additional documents address specific components of a WHP plan. One - "Determining Wellhead Protection Area Boundaries - An Introduction" - describes some of the methods available for delineating a WHP area, from the simple to the complex. This publication discusses the advantages, disadvantages and cost of each method.

   Another WDNR publication is titled "A Guide for Conducting Potential Contaminant Source Inventories for Wellhead Protection" and is designed to assist communities in identifying potential contaminant sources near their wells.

   The WDNR also produced a brochure - "WHP - An Ounce of Prevention" - as an introduction to WHP for distribution to the public and community leaders. This brochure can be sent out to homeowners or be made available at public meetings, festivals, etc., as part of a community's education plan. The WDNR has also provided other educational material, prepared by the WDNR or other sources, tailored to meet a community's needs.

   Since 1993, the WDNR has published a Wellhead Protection Newsletter to keep water supply operators, engineers, consultants, local officials and others informed of WHP activities and to promote WHP. Both newsletters in 1998 were used to solicit comments on Wisconsin's proposed SWAP plan.

2. Public service announcement - A 30-second public service announcement was produced in 1992 and shown on TV stations around the state encouraging local citizens to work with local officials to

develop a WHP plan.

3. Advanced WHP Delineations - In 1995, the WDNR prepared maps showing WHP delineations for all municipalities in the state using a calculated fixed radius method and a 5-year time of travel. Although not sophisticated, it was a method that could be applied to all municipal wells statewide and it takes into account pumping rate, porosity, and the open interval of the well. We have encouraged communities to use more accurate methods if possible. The WDNR helped fund development of a groundwater model in Dane County, which has been used for advanced delineations. The model was developed jointly by the Wisconsin Geological and Natural History Survey (WGNHS) and the U. S. Geological Survey. The WDNR also helped fund an effort by the WGNHS to delineate WHP areas for Sturgeon Bay in Door County. These efforts were supported because of the suitability of the geologic setting for modeling and local commitment to these efforts.

4. Web site - A Bureau of Drinking Water and Groundwater web site was established which contains a list of available publications and the text of the brochure, "Wellhead Protection - An Ounce of Prevention."

5. Work with communities - WDNR staff have worked with communities in a number of ways. The WDNR has made groundwater protection and WHP presentations to a wide variety of audiences, including school children, technical audiences, local communities, and others. Regional water supply engineers have talked with water supply operators/owners and community officials to encourage WHP. Staff have helped communities as requested, supplying information, reviewing draft plans and ordinances, offering advice, etc.

5.2 Wellhead Protection During Source Water Assessment Program Implementation

The WDNR will continue WHP efforts and integrate them with our SWAP program. We will build on our WHP program so that, as source water assessments become available, there will be increased awareness among the general public regarding the need for water supply protection. Among the ways Wisconsin will do this are the following.

1. Update publications - We are currently updating the WDNR's "Template" document to provide more information to assist communities preparing WHP plans. We are also evaluating the need to revise the "delineation" and "contaminant source inventory" publications to keep them current. As the WDNR moves through the SWAP process, we will evaluate the need for further publications to assist communities in WHP planning.

2. Public service announcement - The WDNR is working on a WHP public service announcement to encourage the public to work to protect their public groundwater supplies. The WDNR will consider the need for additional public service announcements to promote WHP. The goal will be to raise public awareness so that, as the assessments are made public, there will be public interest in strengthening water supply protection.

3. Advanced WHP delineations - The WDNR has and will continue to support efforts to develop advanced WHP delineations for communities in the state. The Wisconsin Geological and Natural History Survey and the U. S. Geological Survey have been instrumental in development of groundwater models in the state where there has been local interest and suitable geologic conditions

for modeling. The WDNR is currently supporting efforts in the Lower Fox River Valley and the seven counties of southeast Wisconsin. There is also interest in a groundwater modeling effort in La Crosse County that would include WHP delineations.

4. Web site upgrade- The Bureau of Drinking Water and Groundwater web site has been updated to include information on both WHP and Source Water Protection. A variety of information including a listing of available publications, example WHP ordinances, contacts, and descriptions of Wisconsin's programs have been added to assist communities. The SWAP program plan will be added to the Web site shortly and the WDNR intends to put each of the assessments on the Web site as they are available. This will be an important way for the public to find out about the susceptibility of their community's water supply.

5. Work with communities - The WDNR is committed to working with interested communities to protect their water supplies. Particularly as the source water assessments are completed, the WDNR will make the information available to each community and make staff available to discuss the results of the assessment and the need for additional protection efforts. The assessment results will help prioritize those communities where protection efforts are most critical. The WDNR also intends to explore ways to get counties involved in the WHP process. Several counties, notably Eau Claire, Chippewa, Marathon and Portage, have been active in groundwater protection, including WHP. These counties may have information that could be shared with other counties to facilitate WHP.

6. WHP ordinances - One of the ways the WDNR has been working to assist communities with management options is the compilation of five of the best ordinances which have been adopted in Wisconsin to protect WHP areas. The 5 examples were chosen based on review of a substantial number of ordinances and are considered good models for other communities to consider. Copies of the ordinances have been sent out as requested and four example ordinances are included on the Bureau's WHP and SWP Web site.

   There are a number of publications available that describe WHP management options, both regulatory and nonregulatory. WDNR will evaluate how best to make the information available to communities as they decide how to respond to the assessment results.

5.3 Wellhead Protection as Source Water Protection

When completed, the assessments will include the key elements of a WHP plan. Included in each assessment will be a delineated source water/wellhead protection area, a contaminant source inventory for that area and a susceptibility determination for the contaminant sources. The only remaining key element is a plan for managing the wellhead protection area. The susceptibility determination will identify the relevant information for a community to decide what management step or steps are appropriate to protect its water supply. Communities will, therefore, need only a limited amount of additional work to have a WHP plan in place. The WDNR will work with communities to help identify what management steps might be appropriate for each particular situation.

It is apparent that the SWAP activities will support the objective of the state's WHP program plan to develop and implement WHP plans for all public water systems in the state. The SWAP will facilitate completion of a number of the goals of the WHP program such as: completing delineation of WHP areas and potential contaminant source inventories for all municipal, other-than-municipal and non-transient non-community wells; providing support for more advanced delineations for municipal water supply

wells; providing opportunities to raise public awareness and interest in groundwater protection; providing an opportunity for the WDNR to work with communities in developing WHP plans in response to the completed assessments; providing an opportunity to track WHP activities, especially voluntary efforts; and incorporation of WHP into other state programs.

The efforts described above will complement the SWAP activities in Wisconsin's effort to increase the interest and involvement at the local level in protecting our water supplies in Wisconsin. The initial efforts will be focused on Wisconsin's municipal water supplies since they serve such a large percentage of Wisconsin's citizens. It is anticipated that, in the future, efforts will be focused also on other-than-municipal systems and non-transient non-community systems as well. In all cases, the information provided through the source water assessments will be the key components for completion of a WHP plan.

5.4 Surface Water Source Water Protection

An important part of the SWAP will be establishing relationships with surface water programs to facilitate cooperation in completing assessments and build common strategies for source water protection. One example of this is our proposed source water protection/WHP-related scoring criteria to be used in ranking priority watersheds for funding by the Runoff Management Program. SWP/WHP will account for approximately 7 of the 125 points. Those points will likely be awarded for communities with: 1) SWP/WHP ordinances, 2) voluntary plans, 3) advanced delineations, and/or 4) the presence of surface water systems or groundwater systems under the direct influence of surface water.